R E P O R T   R E S U M E S

ED 016 769 VT 000 697

EMERGENCY VICTIM CARE AND RESCUE, TEXTBOOK FOR SQUADMEN.

OHIO STATE DEPT. OF EDUCATION, COLUMBUS

PUB DATE 65

EDRS PRICE MF-$1.25 HC-$13.36 332P.

DESCRIPTORS- *TEXTBOOKS, *HEALTH OCCUPATIONS EDUCATION, *EMERGENCY SQUAD PERSONNEL, FIRST AID, MEDICAL SERVICES, *RESCUE, ADULT VOCATIONAL EDUCATION,

DESIGNED FOR TRAINING EMERGENCY SQUAD PERSONNEL IN RESCUE PROCEDURES AND VICTIM CARE BEYOND BASIC FIRST AID, THIS TEXTBOOK WAS DEVELOPED BY A COMMITTEE OF SQUADMEN, DOCTORS, NURSES, FIREMEN, AND STATE TRADE AND INDUSTRIAL PERSONNEL TO BE USED IN ADULT TRAINING CLASSES OF FULL-TIME OR VOLUNTEER SQUADMEN. THE INSTRUCTIONAL MATERIAL INCLUDES 26 CHAPTERS WITH PHOTOGRAPHS AND DRAWINGS. NEW MEDICAL FINDINGS REGARDING CLOSED-CHEST HEART COMPRESSION, ARTIFICIAL RESPIRATION, FIRST AID FOR LARYNGECTOMY VICTIMS, AND OTHER PHASES OF FIRST-AID WORK INCLUDING THE MOST RECENT RESCUE PROCEDURES AND TECHNIQUES ARE PRESENTED. REPRESENTATIVE CHAPTER TITLES ARE (1) CHILDBIRTH, (2) COMMON SQUAD EMERGENCIES, (3) OXYGEN THERAPY, (4) ELECTRICAL EMERGENCIES, (5) WATERFRONT OPERATIONS, (6) RECORDS AND REPORTS, (7) POST-MORTEM CONFERENCES, AND (8) LEGAL ASPECTS. EACH CHAPTER PROVIDES AN INTRODUCTION TO THE EMERGENCY, DEFINES TERMS, LISTS SYMPTOMS, AND EXPLAINS THE EQUIPMENT, METHODS, AND PROCEDURES NEEDED TO ADEQUATELY HANDLE THE SITUATION. THE COURSE SHOULD BE TAUGHT BY A QUALIFIED SQUADMAN. AN INSTRUCTOR'S MANUAL (VT 004 066) IS AVAILABLE. THIS TEXTBOOK IS AVAILABLE FOR $4.15 FROM OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE, INSTRUCTIONAL MATERIALS LABORATORY, THE OHIO STATE UNIVERSITY, 1885 NEIL AVENUE, COLUMBUS, OHIO 43210. (HC)

ED016769

EMERGENCY VICTIM CARE AND RESCUE

DIVISION OF VOCATIONAL EDUCATION, STATE DEPARTMENT OF EDUCATION, COLUMBUS OHIO

EMERGENCY
AMBULANCE

VT000697

EMERGENCY VICTIM CARE AND RESCUE

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

TEXTBOOK FOR SQUADMEN

OHIO TRADE AND INDUSTRIAL EDUCATION SERVICE

DIVISION OF VOCATIONAL EDUCATION
STATE DEPARTMENT OF EDUCATION
COLUMBUS, OHIO

"PERMISSION TO REPRODUCE THIS COPYRIGHTED MATERIAL HAS BEEN GRANTED BY TRADE & INDUSTRIAL EDUCATION SERVICE - OHIO TO ERIC AND ORGANIZATIONS OPERATING UNDER AGREEMENTS WITH THE U.S. OFFICE OF EDUCATION. FURTHER REPRODUCTION OUTSIDE THE ERIC SYSTEM REQUIRES PERMISSION OF THE COPYRIGHT OWNER."

SECOND EDITION

Copyright - 1965

Trade and Industrial Education Service

Edited and distributed by the:
Instructional Materials Laboratory
Trade and Industrial Education
The Ohio State University
College of Education
Columbus, Ohio 43210

PREFACE

The Trade and Industrial Education Service within the Division of Vocational Education, The State Department of Education, has assisted public schools to provide training in Trade and Industrial occupations to the citizens of Ohio since 1918. Its purpose has been to prepare young men and women for employment in all types of industrial and service work, as well as to upgrade adult workers for greater efficiency in their chosen field.

Ohio can be truly proud of the vocational instruction provided to local communities in fire service training. This training has undoubtedly been responsible for saving many lives and preventing much property loss in the state. Emergency rescue training has been developed to further serve the citizens of Ohio by providing well-qualified persons to deal with emergency situations. The personnel trained may be members of fire departments, police departments, or other agencies who are involved in the emergency treatment and rescue of people.

This revised and expanded volume is designed to serve as a text for emergency rescue training and includes the latest information on sound practices in emergency squad work.

E. E. Holt, Superintendent of
Public Instruction

Byrl R. Shoemaker
Director of Vocational Education

FOREWORD

The importance of adequate training for emergency squad personnel, in rescue procedures and victim care beyond basic first aid, has been obvious for some time. International as well as national medical and rescue associations have expressed a dire need for a solution to this training problem.

The Ohio Trade and Industrial Education Service, Division of Vocational Education, of the State Department of Education has taken an active part in the training of fire department personnel since 1939. Through the training and utilization of part-time instructors, the Trade and Industrial Education Service has been able to make fire service training available to all fire departments in the state. This training has given assistance to paid departments, and has been of particular help to volunteer departments. More recently a similar program has been developed for training emergency squad personnel in victim care and rescue procedures. Some of these emergency squads are parts of local fire departments and some are not.

In 1959 the Ohio Trade and Industrial education Service published an Emergency Rescue Squad Manual as a part of its training program. This comprehensive text was a pioneer in its field. A survey of literature had failed to disclose adequate materials for a complete training program. The materials available were fragmentary; each omitted vital phases of emergency and rescue squad work. The Emergency Rescue Squad Manual therefore filled a critical need. It has been widely distributed and has been reprinted every year since its publication.

Meanwhile new medical findings about closed-chest heart compression, artificial respiration, first aid for laryngectomy victims, and other phases of first-aid work have been introduced into Ohio's training program for emergency squadmen, along with the most recent rescue procedures and techniques. These new materials have been incorporated in this major revision of the original manual for squadmen titled "Emergency Victim Care and Rescue."

It is sincerely hoped that this revised text will become a part of all training programs for emergency squads within the State of Ohio.

Harry F. Davis, Supervisor
Trade and Industrial Education Service

ACKNOWLEDGMENT

This revised textbook has been a cooperative effort involving many persons concerned with emergency squad training.

The State Fire Service Advisory Committee for Trade and Industrial Education has given its support toward providing for an adequate training program. The organizations represented on this committee are: The Ohio Fire Chiefs' Association; The Ohio State Fire Marshal's Office; The Ohio State Firemen's Association; The Ohio Association of Professional Fire Fighters; The International Association of Fire Fighters; The Ohio Inspection Bureau; and The International Fire Chief's Association.

The first emergency rescue squad manual (1959 edition) was developed by the Ohio Fire Service Training Coordinators and a registered nurse with much rescue experience. The new text was prepared by Jack B. Liberator, R.N., former Emergency and Rescue Squad Training Coordinator for Trade and Industrial Education.

The present staff of Fire Service Training Coordinators are: C.J. Getz, Harry Ohlrich, Joe Heinzen, Frank Potts, and Rocco Morando, Emergency and Rescue Squad Training Coordinator.

A Medical Advisory Committee has given assistance on the chapters dealing with victim care, in order to provide the latest recommendations for care by squadmen. The committee consisted of the following: C. Joseph Hatfield, M.D., and Vol K. Philips, M.D., Internal Medicine; Walter Haynes, M.D., and Jack Tetirick, M.D., General Surgery and Chest Surgery; Charles R. McClave, M.D., and William Baldock, M.D., Pediatricians; John G. Boutselis, M.D., and William Merryman, M.D. Obstetrics; William Hamelberg, M.D., Anesthesiology; Robert R. Kessler, M.D., Orthopedic Surgery. All are staff members or chairmen of departments of the College of Medicine of the Ohio State University.

The Trade and Industrial Education Service also wishes to acknowledge the following persons, institutions, associations, and manufacturers for permission to use pictures, illustrations and certain other material used in this manual; Abbott Laboratories; American Druggist; American Heart Association, Inc.; Blackhawk Manufacturing Company; A.B. Chance Company; E & J Manufacturing Company; The Gerstenslager Company; Greenfield Township Fire Department; Linde Company; Division of Union Carbide Corporation; J.B. Lippincott Company; Loudonville Fire Department; Lynhurst Fire Department; McKesson Appliance Company; Maryland Civil Defense Agency; Mifflin Township Fire Department; Mine Safety Appliances Company; Motorola, Inc.; National Board of Fire Underwriters; National Welding Equipment Company; Northern Hills Fire Department; Ohio State Highway Patrol; Pleasantville Fire Department; Prairie Township Fire Department; Safety Clothing and Equipment Company; W. H. Salisbury & Company; Scott Aviation Corporation; Superior Coach Corporation; Sylvania Township Fire Department; Toledo Fire Department; White Rubber Company; Columbus Fire Department Emergency Squads; Franklin County Firemen's Association; Licking County Firemen's Association; Fairfield County Firemen's Association; Ohio State Fire Marshal's Office; International Rescue and First Aid Association; Medical Advisory Committee; Trade and Industrial Education Services, for Emergency and Rescue Squad Training; St. Anthony Hospital, Columbus; Mount Carmel Hospital, Columbus; Sharon Township Fire Department; Eastern Greyhound Lines; Convaire Aviation Corporation; Dr. Robert M. Reese for photography; Lost Cord Club of Columbus; Clinton Township Fire Department; Yorkville Fire Department; Dr. R. L.Dickinson; Dr. G. P. Shears; Zabriski-Eastman.

TABLE OF CONTENTS

Page

PREFACE iii

FOREWARD v

ACKNOWLEDGMENT . . . . . vi, vii

CHAPTER

I EMERGENCY AND RESCUE VEHICLES
- Local Needs 1
- Types of Emergency and Rescue Vehicles 2
- Care and Maintenance of a Vehicle 7

II EQUIPMENT
- Life-Saving Tools and Equipment 11
- Rescue Tools and Equipment 17
- Miscellaneous Tools and Equipment 19
- Special Equipment 20

III PERSONNEL
- Qualifications 21
- Complement of Emergency and Rescue Units 23

IV OPERATIONS
- Alerting System 25
- Response 26
- Communications 26
- Coding Calls 27

V SAFE DRIVING PRACTICES
- Responding to the Emergency 29
- Transporting Victim to the Hospital 31

VI CONTROLLING THE SITUATION
- Highway Accidents 33
- Cooperation by Pre-Planning 35
- Home Situations 36
- Cooperation of the Victim 36
- Cooperation With Hospital Personnel 37

VII CHILDBIRTH
- Normal Deliveries 39
- Unusual Deliveries 47
- Other Childbirth Emergencies 47
- Abortion or Miscarriage 48

VIII COMMON SQUAD EMERGENCIES
- Burns 49
- Penetrating Wounds of the Eye 52
- Abdominal Injuries 52

CHAPTER Page

VIII COMMON SQUAD EMERGENCIES (continued)

Open Chest Wounds 54
Fractures 55
The Fracture Lesion 56
Convulsions in Childbirth 61
Contagious Diseases 62
Poisons 64
Proper Examination 66
Unconscious Persons 66
Diabetes 67
Epilepsy 68
Stroke 70
General Information About Heart Attack 71
Angina Pectoris 74
Technical Instructions for Squadmen Concerning Coronary Attack 75
Chronic Heart Failure 77

IX THE MENTALLY DISTURBED PATIENT

Care of Emotionally Disturbed People in Large-Scale Emergencies 79
Common Mental Disturbances 82

X RESUSCITATION

Manual Artificial Respiration 85
Rescue of the Unconscious Victim 86
Mechanical Resuscitation 92
Emergency Care of the Laryngectomy Victim 99
Adjuncts to Resuscitation 102
Extra Equipment 102
Resuscitation While Transporting 104

XI OXYGEN THERAPY

Basic Procedure 105
Safe Practices 116
Mass Oxygen Therapy 117

XII CLOSED-CHEST HEART COMPRESSION

Symptoms 119
Transportation 124

XIII USE OF BACKBOARDS

Logrolling 127
Handling of Backboards 134
Removing Victims from an Automobile 138
Conclusion 148

CHAPTER Page

XIV RESCUE CARRIES AND DRAGS
Rescue, Principles, Practices and Equipment 149
Carries and Drags 151
Ladder Rescues 158
Care of Victims After Rescue 160
Rope Slide 161
Radiation Rescue 164

XV AERIAL LADDER RESCUE PROCEDURES
Equipment 165
Procedure 166
Practices 174

XVI FORCIBLE ENTRY
Making Entry by Breaking Glass 175
Making Entry Through Various Types of Doors 176
Making Entry Through Various Types of Windows 178
Making Entry From Roof 179
Making Entry Through Skylight, Cockloft, or Scuttle Hole Cover 181
Making Entry Through Gratings, Dead Lights, and Barred Windows 181
Making Entry by Breaching Walls 182
Making Entry Through Openings, Partitions and Ceilings 182

XVII GAS MASKS
Gas and Radiation Hazards 186
Types and Uses of Gas Masks 187
Filter-Type Canister Masks 190
Fresh Air or Hose Masks 194
Self-Contained Breathing Apparatus 196
Demand-Type Apparatus 196
Self-Generating Oxygen Mask, Forty-Five Minute 199
Self-Generating Oxygen Mask, Thirty Minute 206
Audible Communication with Respiratory Protective Equipment 209
Training Suggestions 209
Summary 210

XVIII ELECTRICAL EMERGENCIES
Recognizing the Danger 211
Acting in an Emergency 212
Handling Energized Wires 213

XIX CUTTING TORCHES
Cutting Torches and Equipment 217
Safe Handling of Oxygen and Acetylene Cylinders 219
Using the Cutting Torch 220
Care of Cutting Torches 223
Rescue Procedure 223

CHAPTER   Page

XX ROPE AND RIGGING
- Rope 227
- Knots, Bends, and Hitches 230
- Rope Splicing Principles and Techniques 235
- Rope Coils 240
- Supplementary Illustrations of Knots and Hitches 243
- Cable 246
- Poles 248
- Victim Rescue 250

XXI SHORING AND TUNNELING
- Sizing Up an Emergency 257
- Techniques and Tools 260

XXII WATERFRONT OPERATIONS
- Boat Handling 267
- Boating Safety 273
- Operations at Scene of Drowning 274
- Summary of Operations at Drowning Scene 287
- Skin Diving 287
- Water Recovery Procedures During Ice Conditions 288

XXIII UNUSUAL SITUATIONS
- Highway Accidents 292
- Home Explosions 293
- Store Building Explosions 294
- Airplane Accidents 296
- Jet Cockpit Entry Procedures 297
- Bus Accidents 300
- Farm Accidents 303
- Operations at a Crime Scene 307

XXIV RECORDS AND REPORTS
- Responsibility for Reports 309
- Important Items on Squad Reports 309

XXV POST MORTEM CONFERENCES
- Why Conduct a Post Mortem Conference 319
- How to Conduct the Conference 319
- Scheduling a Conference 320
- Responsibility and Participation 320
- Items to be Evaluated 321

XXVI LEGAL ASPECTS
- Statutes 323

CHAPTER I

EMERGENCY AND RESCUE VEHICLES

INTRODUCTION

Many of the residents of our communities today are the unfortunate and innocent victims of tragedies and disasters which, needless to say, are increasing in alarming numbers. As more and more traffic accidents, drownings, fires, explosions, tornadoes, floods, airplane crashes, and many other misfortunes occur, there is a tremendous need for well trained men and special equipment to handle these situations. It is a recognized fact that saving lives is of paramount importance where these emergencies occur. But it also must be recognized that the necessary equipment must be on hand to do the job. Emergency rescue units are being organized in steadily increasing numbers throughout the nation, to cope with these new demands. Encouragement to groups of men trying to organize such units is of vital importance. One way to do this is to make certain they are provided with the best training and the best equipment to make them into an efficient life-saving and rescue unit.

LOCAL NEEDS

Local needs for equipment will vary in accordance with the present as well as the future physical and financial conditions and circumstances in each community. It is well to analyze the local situation, to avoid jumping to any hasty conclusions. A number of important preliminary factors must be taken into consideration before attempting to organize an emergency rescue unit which is to provide the facilities normally relevant to its operation. Some of these factors are as follows:

1. Present and potential needs of community or area to be served
2. Topography of land and condition of roads
3. Terrain to be covered, including lakes and rivers
4. Number and availability of personnel to complement apparatus
5. The present and future road and industrial hazards
6. Financial situation relative to buying, maintaining, and providing necessary and additional tools and equipment
7. Continuing future community support of this operation
8. Type of service to be provided
9. Kind and amount of equipment to be carried on vehicles

After determining which of these factors are pertinent to the service you plan to offer the community, it can tentatively be decided what kind of apparatus and equipment is desired.

Now, what further information is needed which might influence a choice in this selection? Here are a few examples which will explain the thinking in this respect.

Where transportation to a hospital is to be carried out for victims of accidents, possibly an apparatus in the ambulance classification might be considered. If, however, local police, fire, or other sources provide such transportation, a greater need might exist for a light panel-type vehicle.

When bodies of water are present in the area to be served, it would be well to consider the possibility of towing or carrying a boat. This would also have some bearing on the size and type of vehicles to be selected.

Busy highways, expressways, turnpikes where major traffic accidents are apt to occur involving heavy tractors, trailers, and various large trucking operations, would probably indicate the need for a heavy rescue vehicle equipped with heavy rescue tools and appliances.

TYPES OF EMERGENCY AND RESCUE VEHICLES

Now let us assume that the need for a vehicle has been tentatively decided, and the selection of a vehicle is in order. What is available? In brief, here is a collective description and explanation of the potential units to choose from, to satisfy local needs.

There are three main styles of vehicles used by emergency and rescue units. Each style is suited for a particular emergency or rescue operation.

AMBULANCE

The ambulance is used almost entirely for transportation, but it may be designed for light rescue work.

There are various designs of ambulances built today by reputable manufactures. Many of these are "stock models". but others are built according to a buyer's specifications. Before a rescue squad decides which ambulance is best suited for their needs, the expected use of the vehicle must be established, along with the necessary tools and accessories which will be included. Although ambulances are used primarily for transportation, many of them carry first aid appliances, supplies and accessories including oxygen breathing apparatus. (See Figures 1 and 2.)

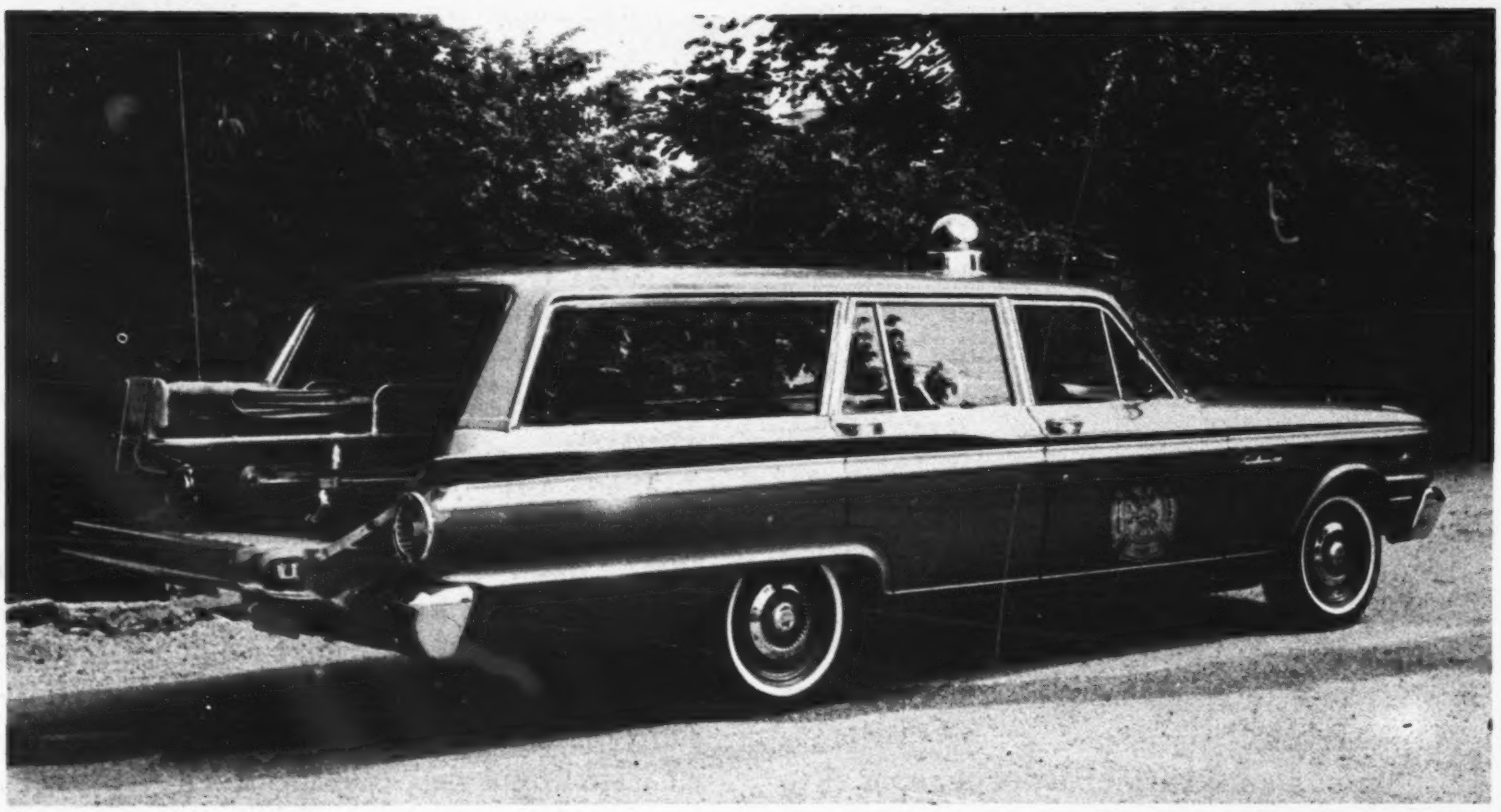
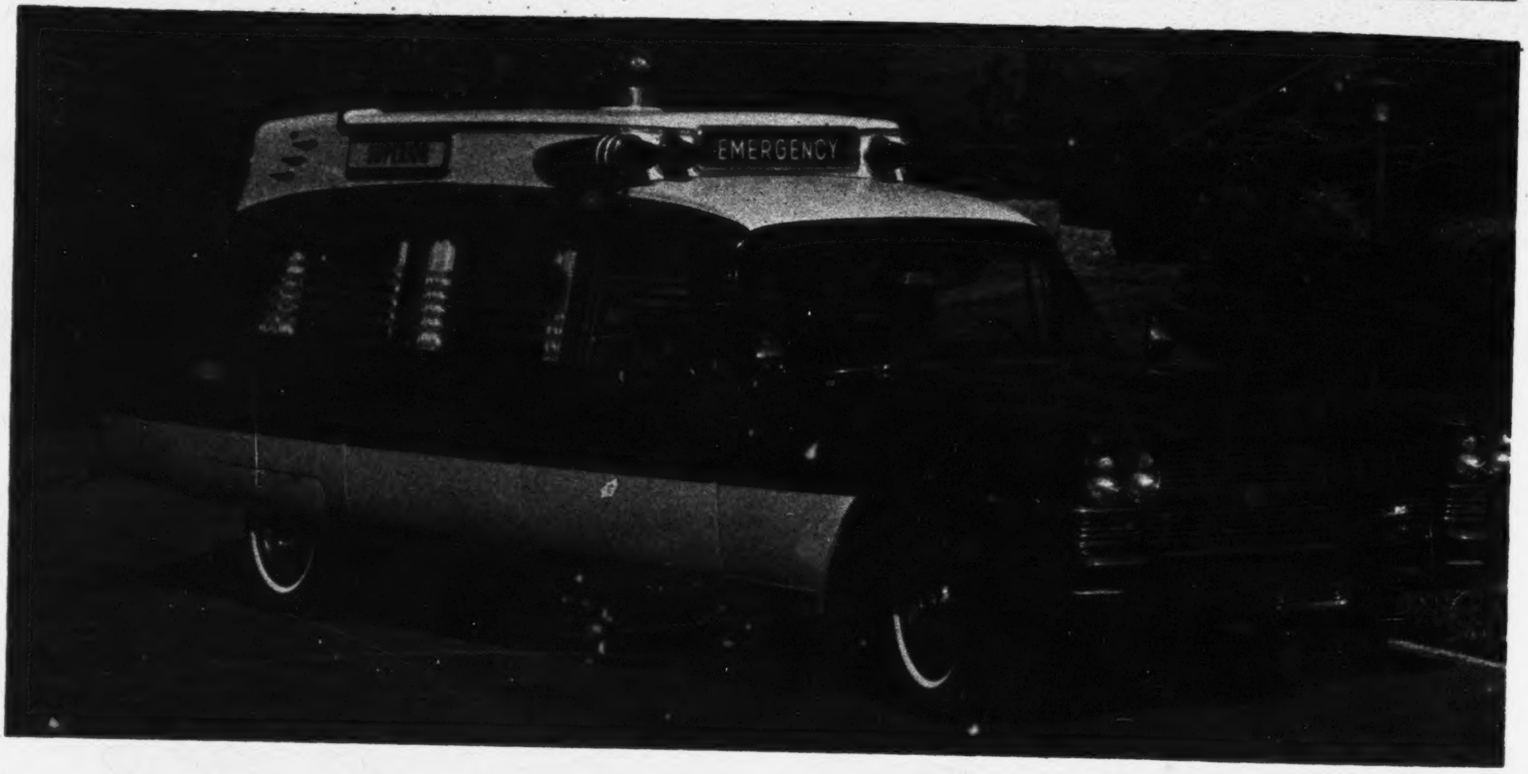


Figure 1

Small ambulance



Courtesy Superior Coach Corp.

Figure 2
Large ambulance

This equipment is generally arranged to permit its use as follows:

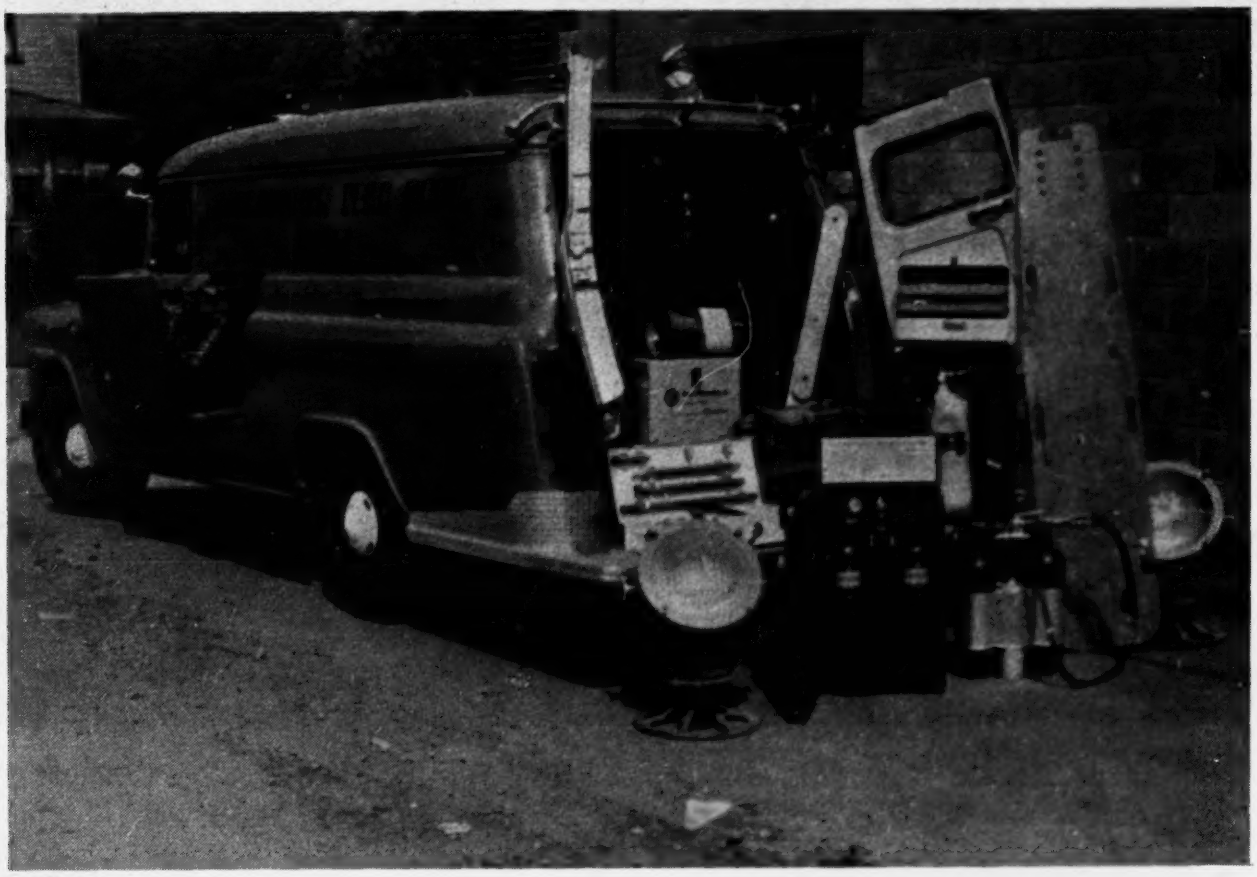
1. At the scene of an accident
2. Enroute to a hospital
3. While transporting a victim to or from the ambulance

It is important, however, that the buyer make a careful study to determine exactly what is needed. This will aid in drawing up the specifications which subsequently can be presented for bids. It is equally important to select the proper automotive chassis, in order to satisfactorily fulfill the needs in respect to safety, ease of handling, and the terrain to be traveled.

LIGHT RESCUE

The light rescue vehicle is adapted mainly for light rescue operations because of its restricted carrying capacity. However, in some instances these units are designed so they may also be used for transporting a victim or victims if necessary.

This type of equipment is generally built along the "panel" or "semi-panel" design, having a road capacity from one-half to one and one-half tons. One of the many functions it must often perform is to transport a boat, either on the top of the truck or by the aid of a trailer. In either case such an arrangement demands careful planning. These trucks are also designed to carry light rescue tools and equipment such as forcible-entry tools, jacks, breathing apparatus, masks, protective clothing, etc., plus the normal first aid supplies. In selecting this type of equipment for a rescue unit, prime consideration must be given to load limits so that the vehicle will not be overloaded beyond the weight for which it was built. (See Figure 3.)



Courtesy Doylestown F.D.

Figure 3
Light rescue vehicle

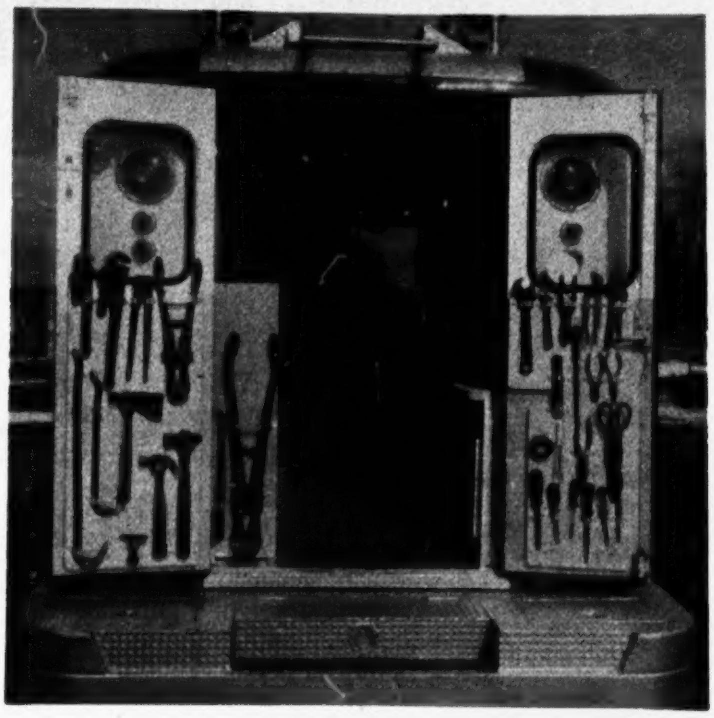
HEAVY RESCUE

The heavy rescue vehicle is designed primarily for heavy-duty operations where a maximum carrying capacity is required, to transport all the tools, appliances and equipment to perform such operations. Some carry portable generators that operate saws, drills, hammers, and forced-air ventilating systems. Many of these heavy-duty units are equipped with a winch and cable for pulling heavy objects and/or "frame hooks" to be used with a tow-chain. Where these "straining" operations are to be demanded of the equipment, specifications should so state these provisions and include the necessary power units to perform such functions. (See Figures 4 and 5.)

Such a truck normally carries three to five tons above the weight of the truck itself. It is well to have a 20 per cent to 25 per cent weight allowance above the total weight of present equipment and men, because as time goes on, new and additional tools will be added and only a few will be discarded. Specifications should present instruction to the manufacturer to build a heavy-duty rescue truck having an engine and correlated parts designed to produce safe road-speed performance at safe engine revolutions per minute on the terrain it will normally travel. An extensive study of rescue trucks should be made before arriving at a final decision. Heavy-duty rescue trucks are not used for transportation of victims except in extreme emergencies.

Courtesy Northern Hills F.D.

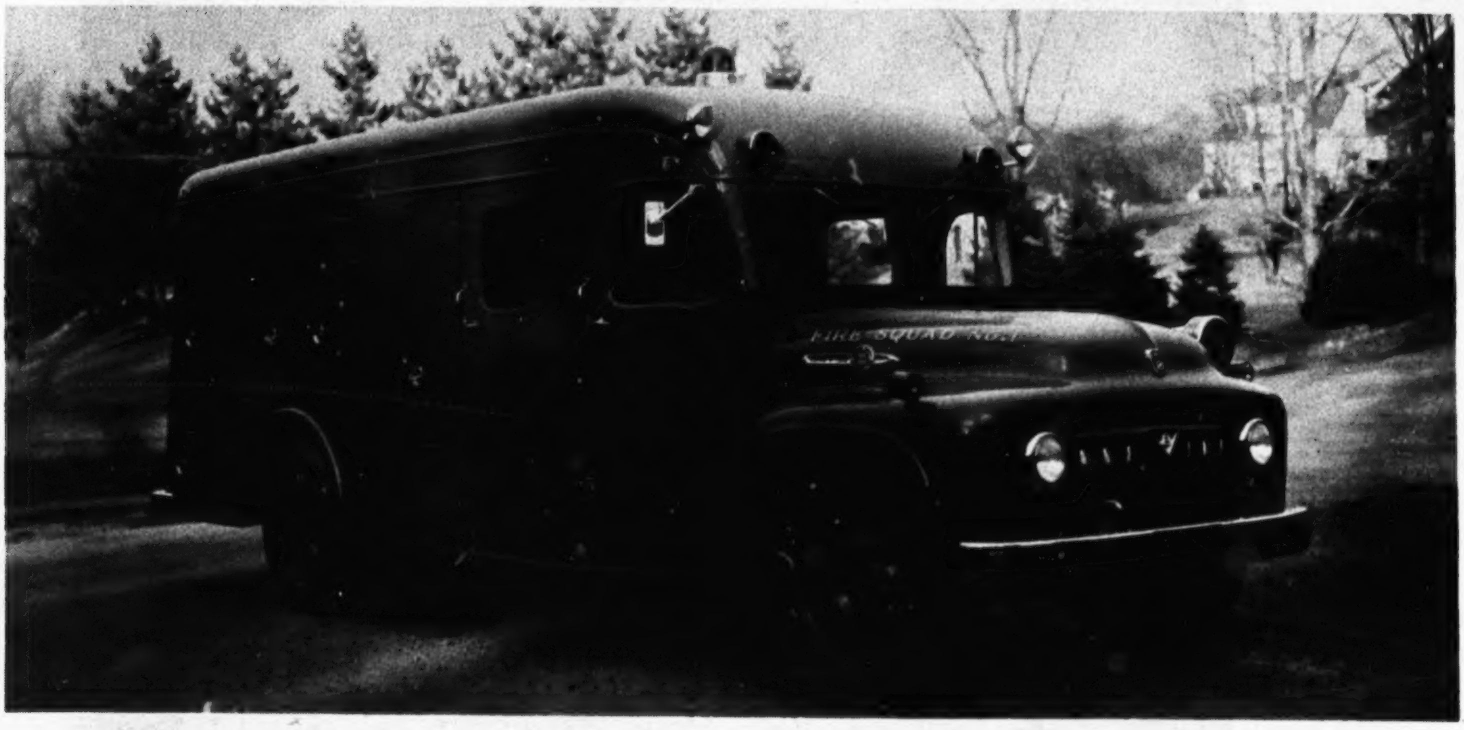
Figure 4A



Courtesy Northern Hills F.D.

Figure 4B

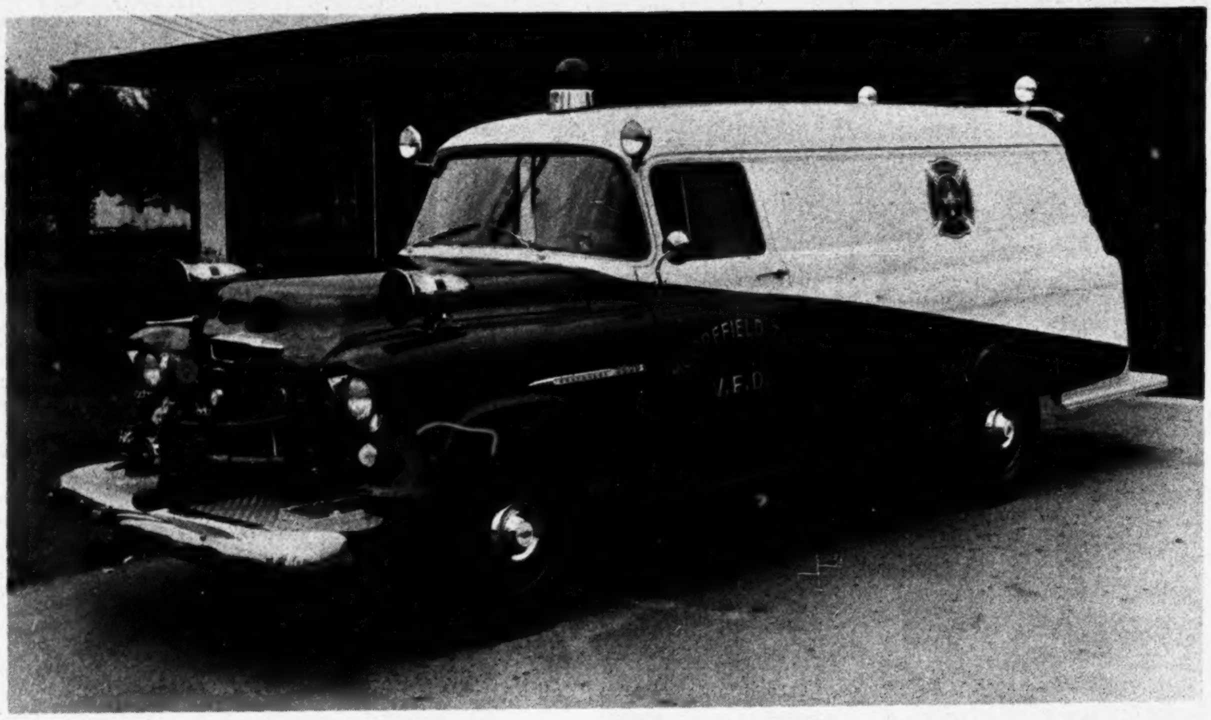
Two views of a heavy rescue vehicle



Courtesy The Gerstenslager Co.

Figure 5

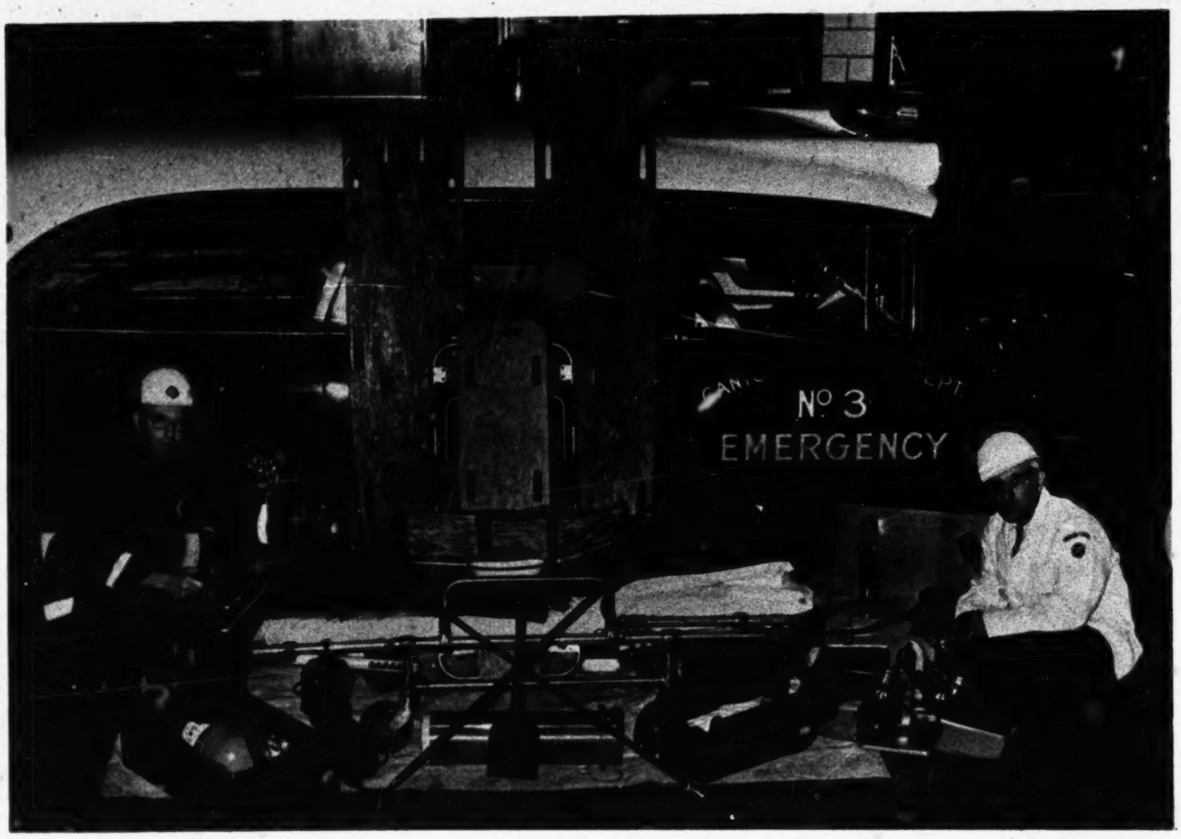
Heavy rescue vehicle



Courtesy Moorefield F.D., Piedmont, O.

Figure 6

A unique squad vehicle. It can transport, carry rescue tools, and also carry a tank of water for fire-fighting or stand-by. The vehicle shown above has all of these features plus a 500 g.p.m. front-mount pump. It can play many roles in emergency service.



Courtesy Canton Twp. F.D., Canton, O.

Figure 7

One might think that an ambulance is too small to do a proper emergency rescue squad job. As this photo shows, a great deal of equipment can be carried in an ambulance.

CONCLUSION

In conclusion it may be well to emphasize certain points which should be considered in the specifications before the selection and purchase of any vehicle, regardless of its classification:

1. Weight of chassis
2. Weight of equipment
3. Hauling weight (trailer and boat)
4. Horsepower
5. Type of wheels (single or dual)
6. Load limit established by manufacturer
7. If a used vehicle is considered, what is its mechanical and physical condition?

Overloaded vehicles result in breakdowns which render the unit unusable and unable to provide the service for which it was intended. Do not make the mistake of attempting to haul three tons of equipment on a one-ton truck.

CARE AND MAINTENANCE OF A VEHICLE

The care and maintenance of any emergency unit and every piece of equipment it carries is the direct responsibility, function, and obligation of those assigned to carry out this duty. Such responsibility should be delegated to dependable and reliable officers or men. But, regardless of who performs the clean-up operation, the officer in charge should direct the work and inspect the results. This procedure is not meant to infer that the men who did a clean-up job cannot be relied upon, but rather it places the different levels of responsibility where they belong. After all it is the officer's duty to see that this unit is ready to respond at all times.

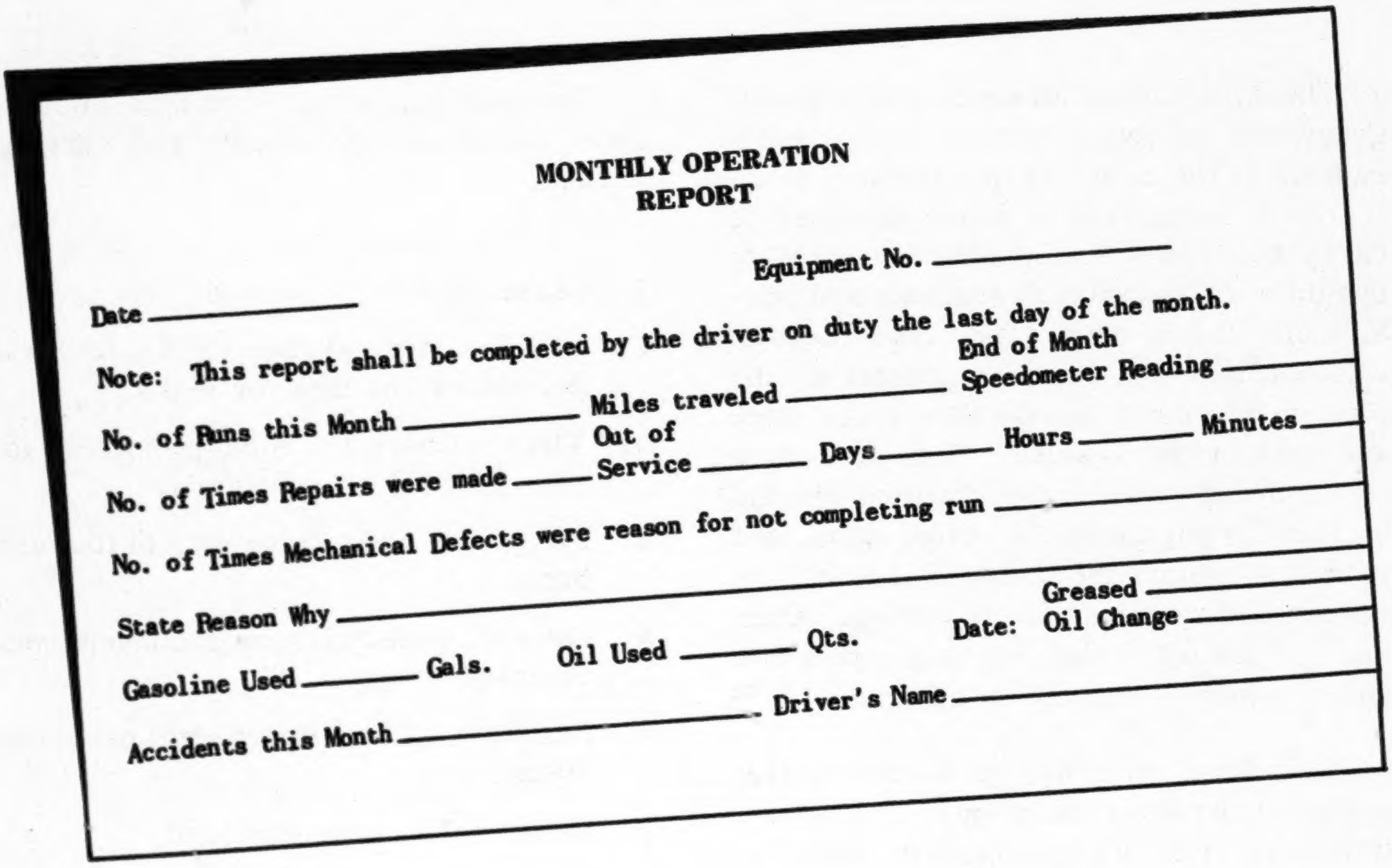
Therefore, in order to insure instant and efficient performance by an apparatus, it is imperative that certain items be checked and inspected after each run. The following list can be used as a guide to direct this inspection service. Other items can be added by the local department in accordance with existing policies, rules, and regulations.

The following items should be checked after each run for defects and services needed:

1. Brakes and their related parts
2. Gasoline and oil levels - Replenish if necessary and look for leaks.
3. Tires - Check for foreign bodies, for cuts, and for air pressure.
4. All gauges and instruments of the dash board
5. Battery, especially on radio-equipped vehicles
6. Radiator - Check water level of cooling system.
7. Safety belts, if so equipped
8. Lights - Head, tail, stop, directional, dash, dome, and warning lights
9. Steering mechanism
10. Mirrors - Rear and side(s)
11. Siren - Check for proper operation.

While on the subject of care and maintenance, one very important factor in this respect which must not be overlooked is CLEANLINESS. It has been very well established that one of the trademarks of any good emergency unit is its appearance. The squad truck must be kept clean inside and out, to protect patients as well as squadmen. The handling of contagious diseases is a good example of a reason for keeping the squad unit clean.

In addition to the routine inspection, it is advisable to have a complete and thorough periodic check of the automotive equipment. It is recommended that this be made on at least a monthly basis. An inspection record should be maintained on a report form, which will be filed for reference. The driver, a mechanic, or whoever is qualified or detailed to do this work as stipulated by local policy, should be held responsible for this job. Figures 8 and 9 are copies of forms used at the present time by some departments. Please note that only the signature of the person making the inspection is included on one of these, while on the other an additional signature by the officer is required. The latter definitely indicates to the officer the defects reported and his signature certifies he is aware of them. However, local policy should determine the procedure to be followed.



MONTHLY OPERATION
REPORT

Equipment No. ____________

Date ____________

Note: This report shall be completed by the driver on duty the last day of the month.

No. of Runs this Month ________ Miles traveled ________ End of Month Speedometer Reading ________

No. of Times Repairs were made ______ Out of Service ______ Days ______ Hours ______ Minutes ______

No. of Times Mechanical Defects were reason for not completing run ________

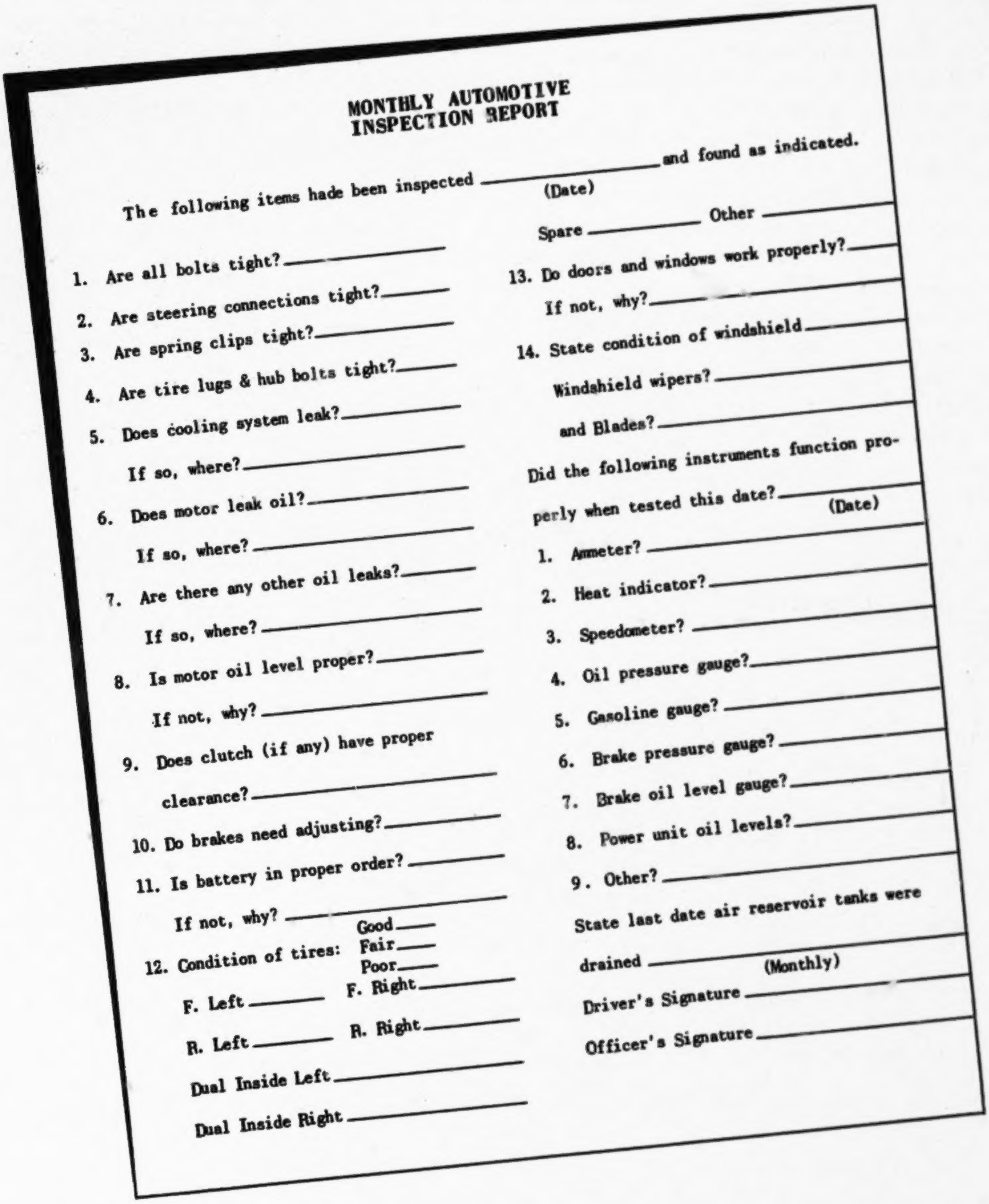
State Reason Why ____________

Gasoline Used ______ Gals. Oil Used ______ Qts. Date: Greased ______ Oil Change ______

Accidents this Month ____________ Driver's Name ____________

Figure 8

Monthly operation report



MONTHLY AUTOMOTIVE
INSPECTION REPORT

The following items hade been inspected ____________ and found as indicated.
(Date)

1. Are all bolts tight? ____________
2. Are steering connections tight? ____________
3. Are spring clips tight? ____________
4. Are tire lugs & hub bolts tight? ____________
5. Does cooling system leak? ____________
   If so, where? ____________
6. Does motor leak oil? ____________
   If so, where? ____________
7. Are there any other oil leaks? ____________
   If so, where? ____________
8. Is motor oil level proper? ____________
   If not, why? ____________
9. Does clutch (if any) have proper
   clearance? ____________
10. Do brakes need adjusting? ____________
11. Is battery in proper order? ____________
    If not, why? ____________
12. Condition of tires: Good____ Fair____ Poor____
    F. Left ________ F. Right ________
    R. Left ________ R. Right ________
    Dual Inside Left ____________
    Dual Inside Right ____________
    Spare ________ Other ________
13. Do doors and windows work properly? ____________
    If not, why? ____________
14. State condition of windshield ____________
    Windshield wipers? ____________
    and Blades? ____________

Did the following instruments function properly when tested this date? ____________
(Date)

1. Ammeter? ____________
2. Heat indicator? ____________
3. Speedometer? ____________
4. Oil pressure gauge? ____________
5. Gasoline gauge? ____________
6. Brake pressure gauge? ____________
7. Brake oil level gauge? ____________
8. Power unit oil levels? ____________
9. Other? ____________

State last date air reservoir tanks were drained ____________
(Monthly)

Driver's Signature ____________
Officer's Signature ____________

Figure 9

Monthly automotive inspection report

CHAPTER II

EQUIPMENT

INTRODUCTION

No greater service can be provided by any emergency or rescue squad than the saving of human lives. When an emergency occurs in which life is in danger, it is the duty of the emergency unit to be so equipped and trained that it will be able to render efficient and effective service.

To meet this obligation, squadmen must carry in their vehicle sufficient rescue and life-saving equipment to meet these situations. The equipment must be maintained in first class condition at all times, and everyone assigned to the rescue unit must be thoroughly trained in and familiar with its use.

Basic tools and equipment can be divided into two categories: those used for life saving and those used for rescue work.

NOTE: The following list of tools and equipment, although very comprehensive in nature, does not include every piece of equipment that might be used. Additional items pertinent to this operation can be added in accordance with local needs. The items chosen, and the quantities, must be in keeping with the type and size of vehicle.

LIFE-SAVING TOOLS AND EQUIPMENT

These include appliances necessary to save life and/or sustain life until the arrival of medical assistance or while enroute to a hospital.

FRACTURE EQUIPMENT

Fracture kit
- 12 Triangular bandages
- 6 Large safety pins
- 6 4 x 4 sterile compresses
- 6 4 x 12 inch splint boards
- 1 Roll 1-inch tape
- 6 Wooden tongue blades
- 1 Roll 2-inch gauze

This equipment should be assembled and carried in a container marked "Fracture Kit."

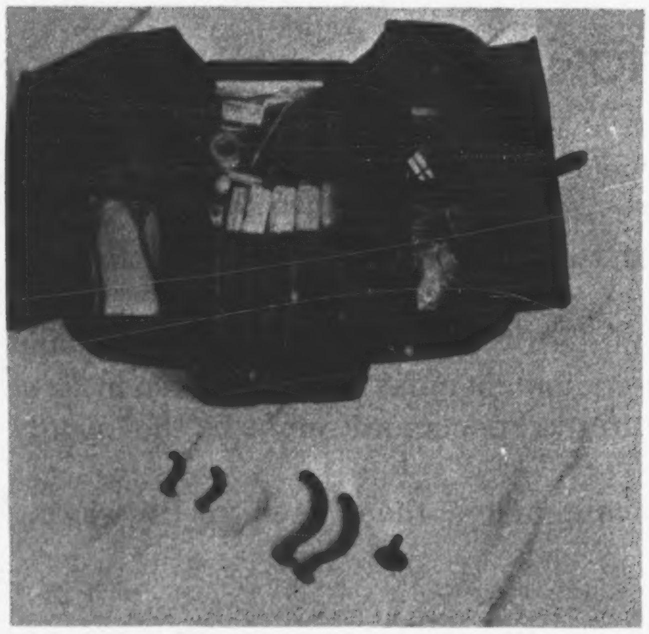
Additional equipment
- 2 Traction splints
- 4 Straps (5' x 4") to secure the patient to stretchers or backboards

OXYGEN - ADMINISTERING EQUIPMENT

Straight inhalator
Combination resuscitator, inhalator, aspirator with 50 ft. extension
Two extra tanks for each

FIRST AID KITS

Squad first aid kit (See Figure 1)
Large commercial first aid kit
(See Figure 2)



Courtesy Sharon Twp. F.D.

Figure 1

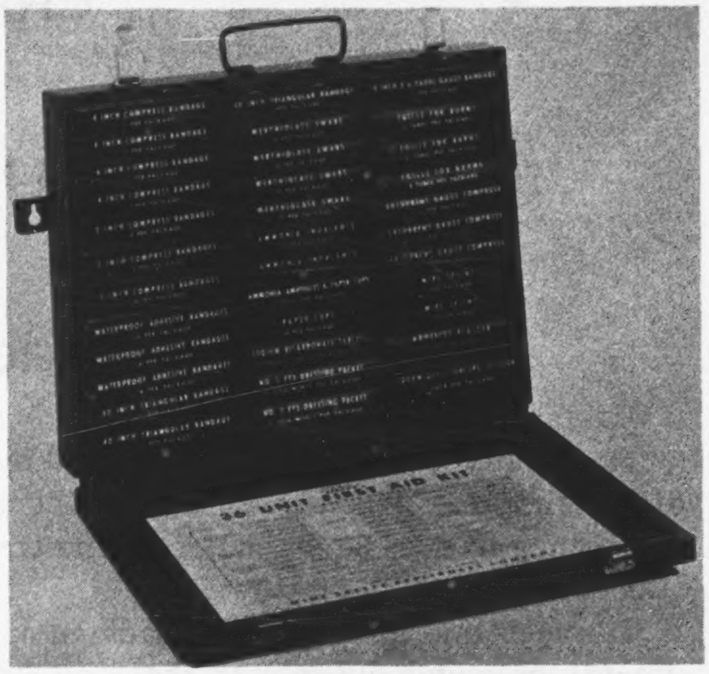
Many squads use a physician's bag or one similar as their first aid kit. These bags are durable and convenient. Note that one compartment holds emergency supplies for a physician. These supplies can be chosen on the recommendations of your local physician. The remaining part of the kit is filled with first aid supplies.

BLANKET ROLL SPLINT

This is made with a small blanket folded until it is 12 inches wide. It is then rolled from each end to the middle. It should be rolled very tight. Three cravat bandages can be tied around it to keep it in place. (Pictures on page 59.)

BLANKETS

Wool blankets should be available, to place under a victim or to wrap around him.



Courtesy Mine Safety Appliances Co.

Figure 2

Large commercial first aid kit

STERILE SHEETS

These sheets should be of white cotton material and be kept sterilized. Note: Local hospitals in some areas cooperate in providing sterilization service. Sheets can also be purchased pre-sterilized.

RUBBER SHEETS

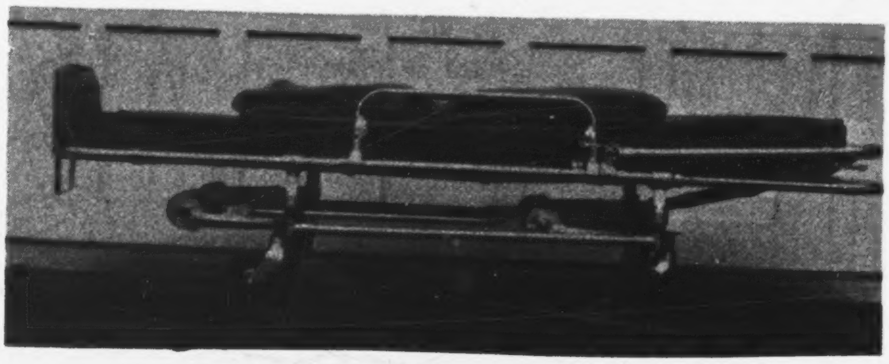
These sheets are used for protection of blankets, cots, etc.

O.B. (OBSTETRICAL) KIT

4 Hemostats (straight)
2 Foot-long pieces of umbilical tape
3 Pairs of sterile gloves
(assorted sizes)
1 Pair of sterile scissors
1 Ear syringe
Sterile towels
Soft baby blankets
Silver nitrate for installation into eyes
(Pictures on page 43.)

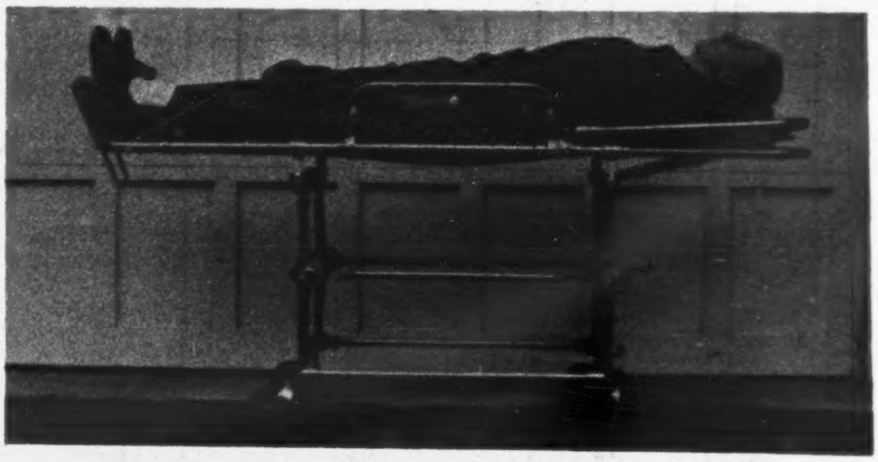
STRETCHERS

Ambulance-type (See Figure 3 and 4)
Collapsible stretcher (See Figure 5)
Adult backboard (See Figure 6)
Child backboard (See Figure 7)
Backboard foot rests (See Figure 6)



Courtesy Sharon Twp. F.D.

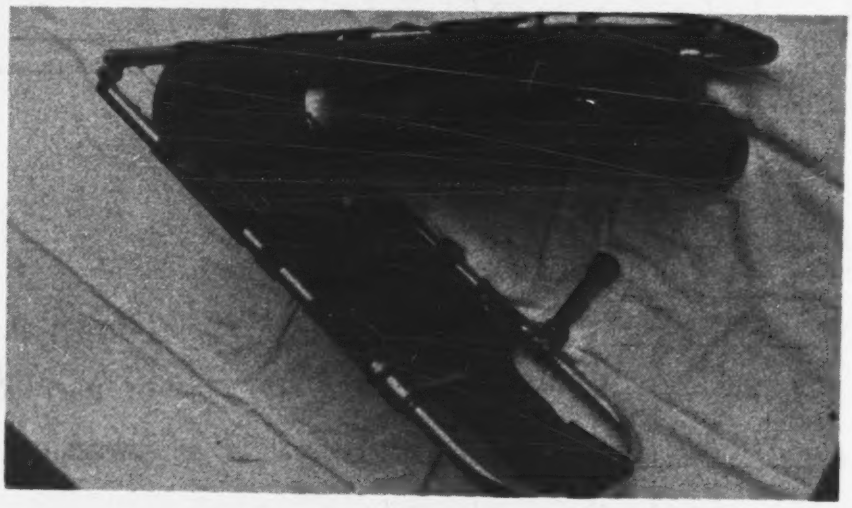
Figure 3



Courtesy Sharon Twp. F.D.

Figure 4

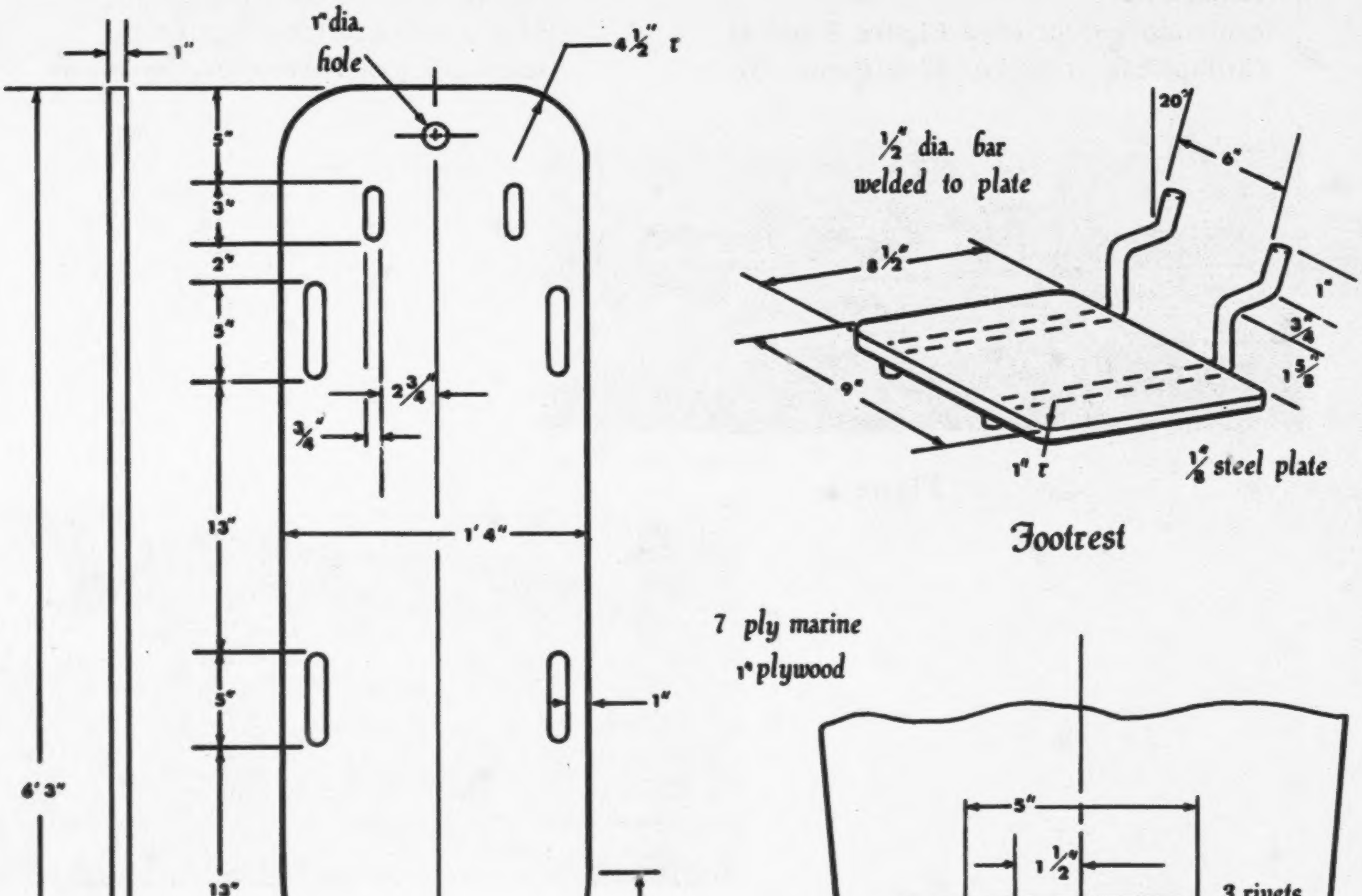
The newest type of stretcher is adjustable. It can be carried in the squad vehicle as shown in Figure 3. Upon arrival at the hospital, this stretcher can be raised to the height of the hospital cart, table, or bed, as shown in Figure 4. This permits transferring the patient with a minimum of movement, and eliminates lifting.



Courtesy Sharon Twp. F.D.

Figure 5

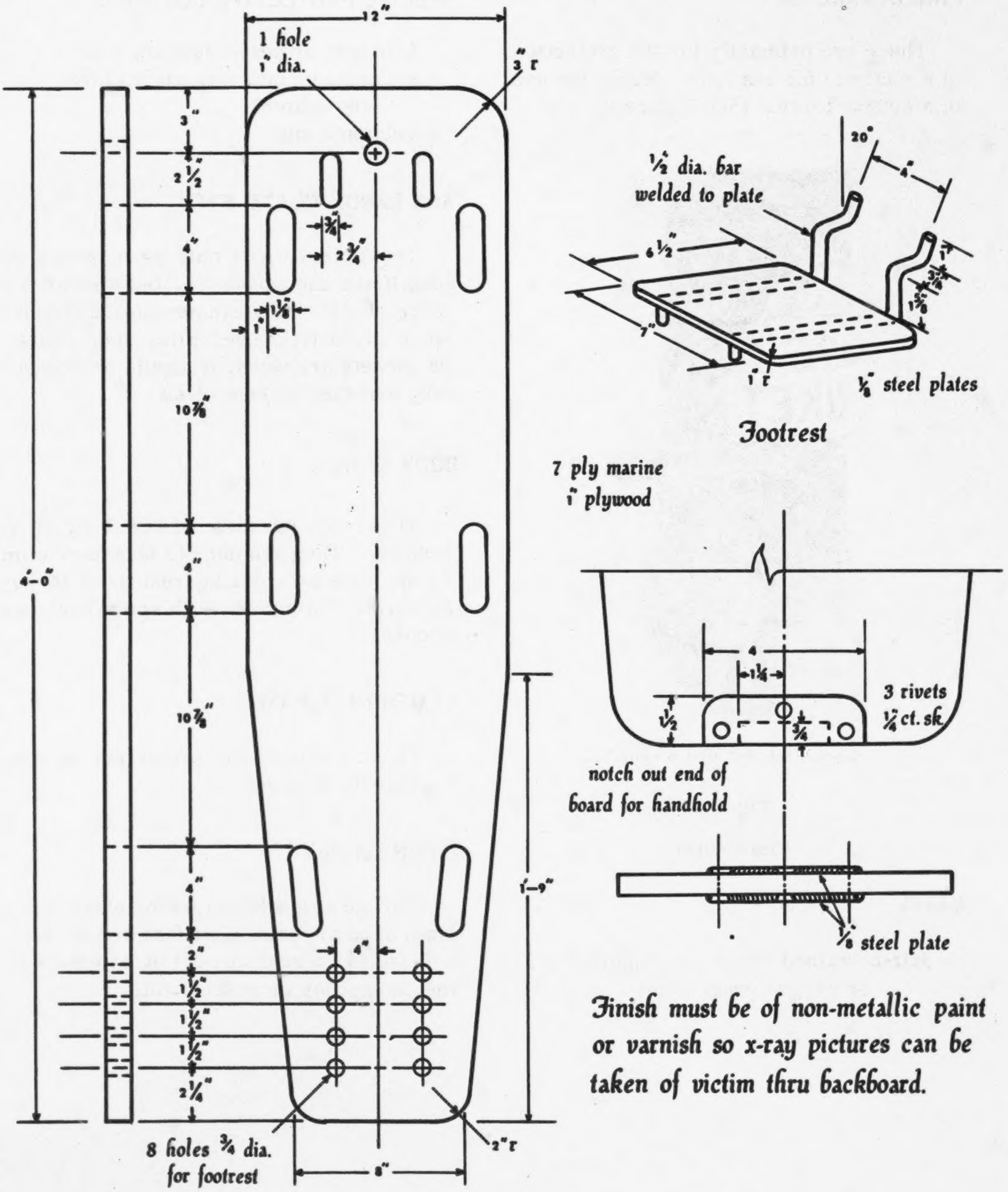
It is good practice to have an additional stretcher available on the squad truck. Multiple-injury accidents require the squad to transport more than one patient. The stretcher shown here is collapsible; it can be stored in the squad truck until needed.


1"
1" dia. hole
4½" r
5"
3"
2"
5"
2¾"
¾"
13"
1' 4"
5"
1"
6' 3"
13"
5"
2' 10"
10½"
2"
2"
2"
3½"
3"
1¼" r
11"
8 holes ¾" dia. for footrest
½" dia. bar welded to plate
20°
6"
8½"
1"
¾"
1⅝"
9"
1" r
⅛" steel plate
Footrest
7 ply marine 1" plywood
5"
1½"
1½"
¾"
3 rivets ¼" ct.sk.
notch out end of board for handhold
⅛" steel plates

Finish must be of non-metallic paint or varnish so x-ray pictures can be taken of victim thru backboard

Figure 6

Adult backboard


12"
1 hole
1" dia.
3" r
3"
2 1/2
4"
3/4"
2 3/4"
1 1/8
1"
10 7/8"
4'-0"
4"
10 7/8"
4"
1'-9"
2"
4"
1 1/2"
1 1/2"
1 1/2"
2 1/4"
8 holes 3/4 dia.
for footrest
2" r
8"
1/2 dia. bar
welded to plate
20"
4"
6 1/2"
7"
1"
3/4"
1 5/8
1" r
1/8" steel plates
Footrest
7 ply marine
1" plywood
4
1 1/4
1 1/2
3/4
3 rivets
1/4 ct. sk.
notch out end of
board for handhold
1/8 steel plate

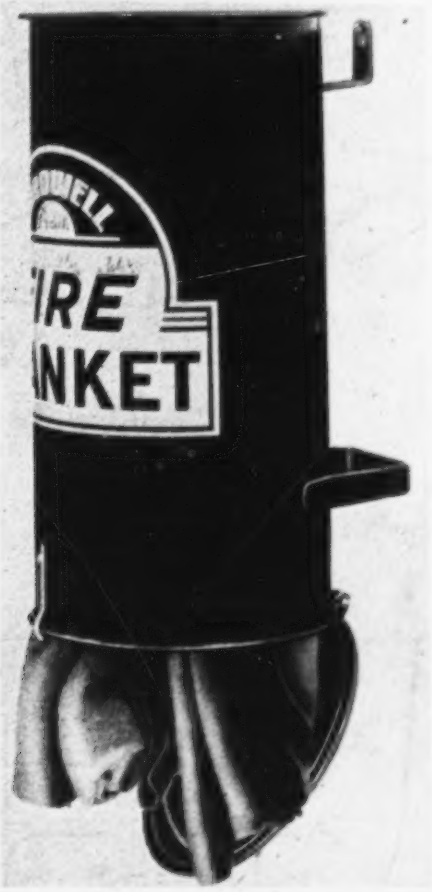
Finish must be of non-metallic paint or varnish so x-ray pictures can be taken of victim thru backboard.

Figure 7

Child backboard

FIRE BLANKETS

These are primarily for the protection of a victim: for example, during the use of a cutting torch. (See Figure 8)



Courtesy Safety Clothing & Equip. Co.

Figure 8

Fire blanket

MASKS

Self-contained (demand, supplied air, or oxygen generating)

SPECIAL PROTECTIVE CLOTHING

Asbestos or heat-resistant suits
Asbestos or heat-resistant gloves and mittens
Ammonia suit

ARM BANDS, COATS, ETC.

These serve not only as a means of identifying the squadmen, but also afford protection for the squadmen and the victim. When protective cover-alls, shop coats, or jackets are worn, it should be mandatory that they be kept clean.

BODY STRAPS

These can be made of leather or of webbing. They are used to lash the victim to the stretcher during rescue or to restrain the victim when such action becomes necessary.

CLOTH FACE MASKS

These are used for protection against contagious diseases.

LINEN SUPPLY

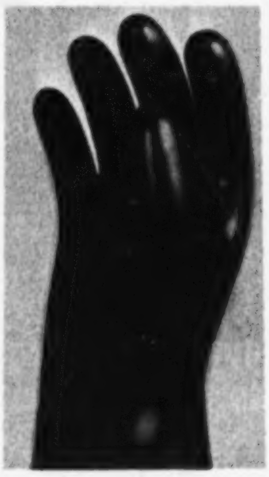
Storage at headquarters for extra blankets, sheets, coats, cloth face masks, etc. will facilitate replacement of materials in the emergency or rescue units.

RESCUE TOOLS AND EQUIPMENT

These involve appliances used to rescue people trapped in various critical circumstances, such as automobile accidents, drownings, cave-ins, explosions, etc.

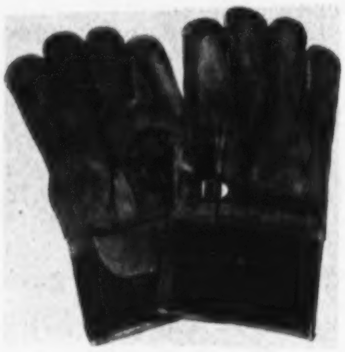
ELECTRICAL SAFETY EQUIPMENT

Rubber gloves and protectors
(See Figures 9 and 10)
Wire cutters (See Figure 11)
Firemen's cutters (insulated)
Wire holding stick (See Figure 12)
Pipe wrench (large)



Courtesy White Rubber Co.

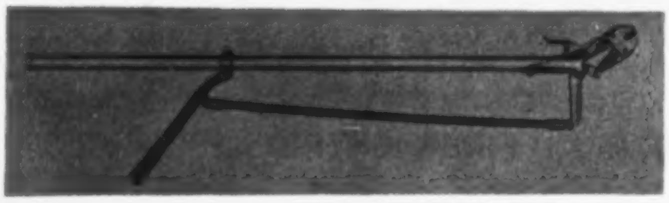
Figure 9



Courtesy W.H. Salisbury & Co.

Figure 10

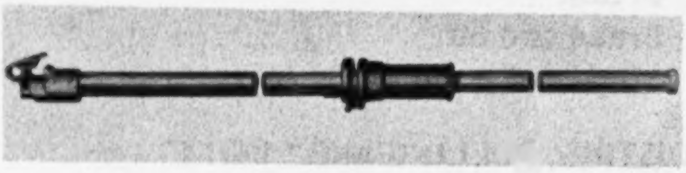
Rubber glove, glove protectors



Courtesy A.B. Chance Co.

Figure 11

Wire cutters



Courtesy A.B. Chance Co.

Figure 12

Wire-holding stick

STRIKING TOOLS

Axes (pick head, flat head, hand axe, etc.)
Hammer (sledge, rubber head, mallet, etc.)
Picks (hammer head, mattock, plain, etc.)

CUTTING TOOLS

Wood cutting (electric or manual saw, air hammer, chisel)
Masonry cutting (electric or manual saw, air hammer, chisel, star drill, etc.)
Metal cutting (electric saw, hack saw, cold chisel, tin roof cutter, bar cutter, oxy-acetylene torch, tin snips, finger-ring cutters, bolt cutters)

BATTERING TOOLS

Battering ram
Ball on chain

PRYING AND LIFTING TOOLS

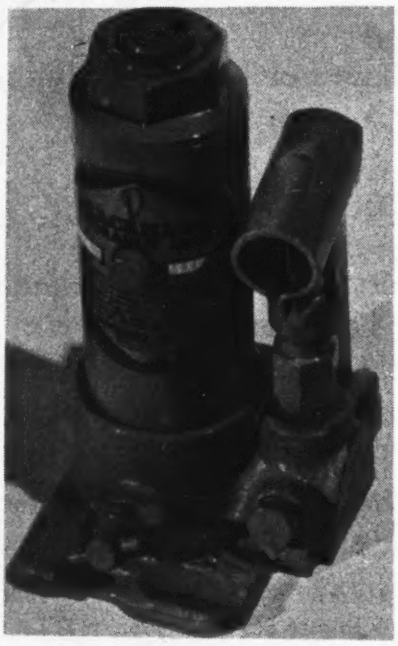
Claw tool
Door opener
Hux bar
Crow bar

BORING AND DRILLING TOOLS

Electric
Breast
Brace and bit
Metal and wood drills in assorted sizes

HOISTING, PULLING AND LIFTING EQUIPMENT

Rope ($\frac{1}{2}$" to 1")
Block and tackle
Sheave block
Assorted rope
Pike pole
Ratchet jack
Hydraulic jack (See Figure 13)
Log chain
Cable
Hydraulic rescue kit (See Figure 14)



Courtesy Blackhawk Mfg. Co.

Figure 13

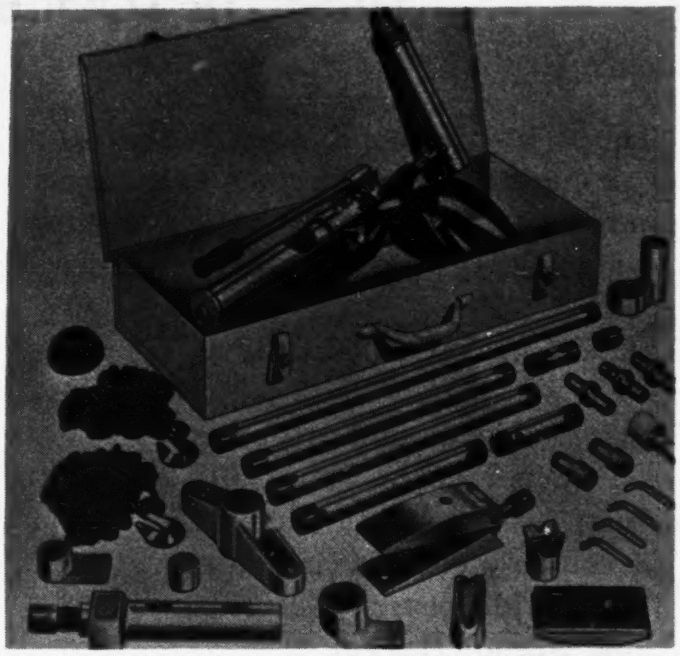
Hydraulic jack

CUTTING TORCH

Oxy-acetylene

LADDERS

Rope
Collapsible



Courtesy Blackhawk Mfg. Co.

Figure 14

Hydraulic rescue kit

LIGHTING EQUIPMENT

Flashlight (one per man)
Hand lamp
Portable electric generator with lights (See Figure 15)

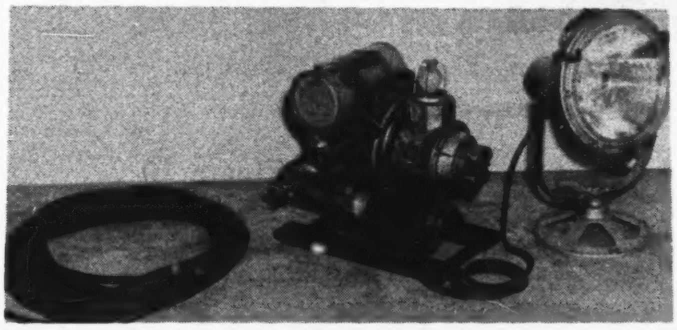


Figure 15

Portable electric generator

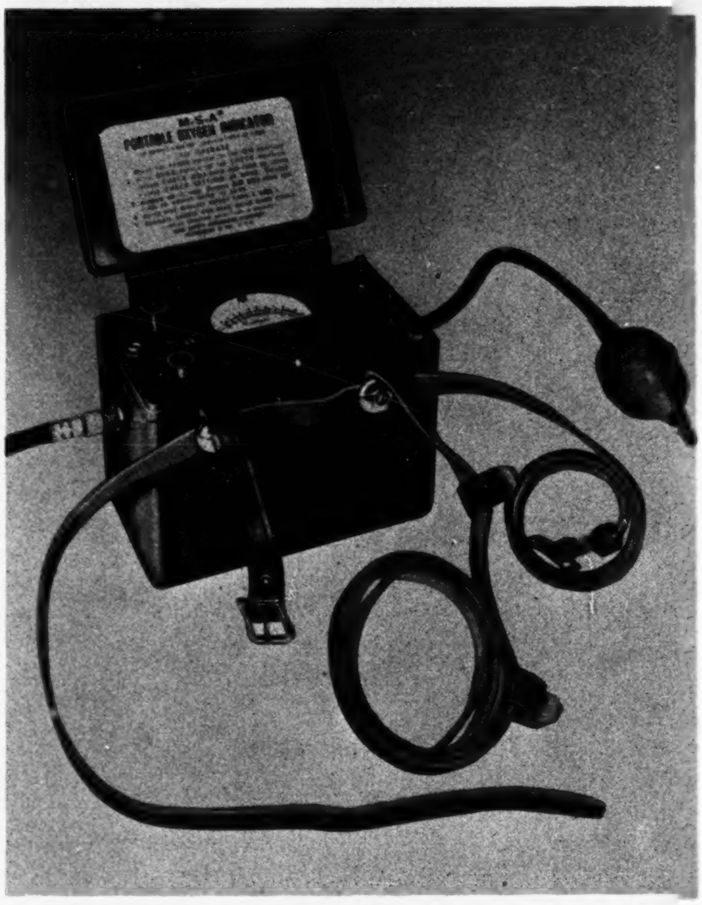
FIRST AID FIRE-FIGHTING APPLIANCES

Pressure-type water extinguishers
Soda and acid
Foam
Carbon dioxide
Dry powder

MISCELLANEOUS TOOLS AND EQUIPMENT

The following is a list of tools and equipment which do not fall directly into previous classifications, but which may be important in equipping your emergency or rescue squad.

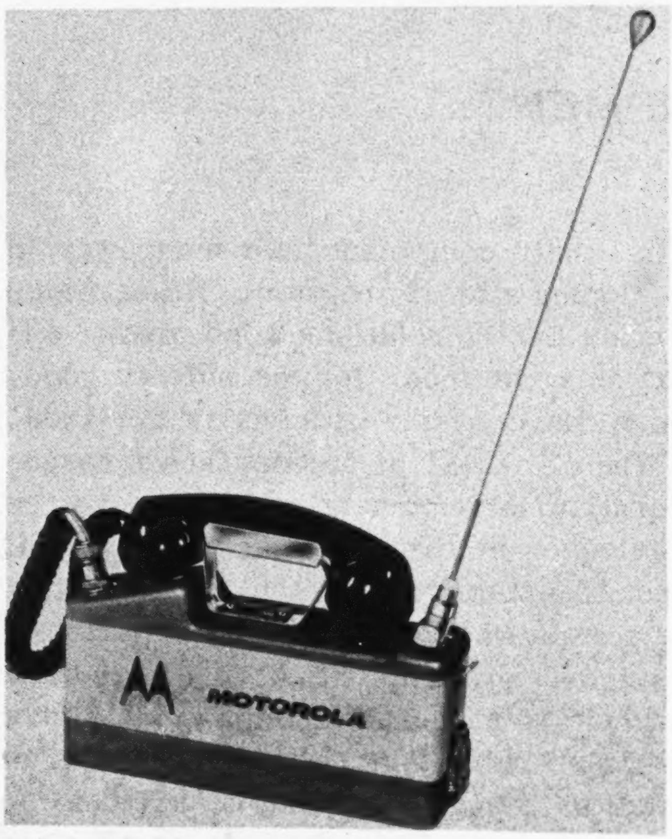
Salvage covers
Pike poles
Fire helmets
Rubber body wrapper
Ditch jacks
Rescue harness
Life jackets
Small hose roller
Small folding ladder
Large screwdriver
Long and short-handled shovels
Walkie-Talkie radios (See Figure 16)



Courtesy Mine Safety Appliances Co.

Figure 17

Portable oxygen indicator

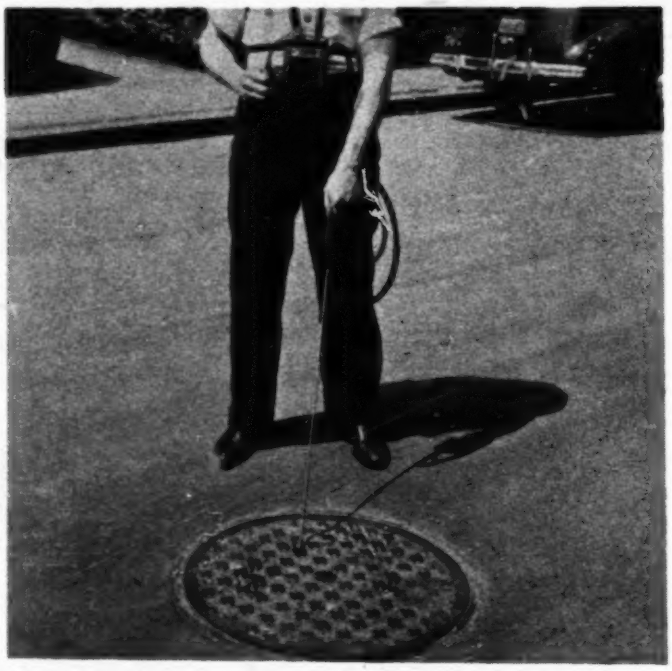


Courtesy Motorola Inc.

Figure 16

Walkie-talkie radio

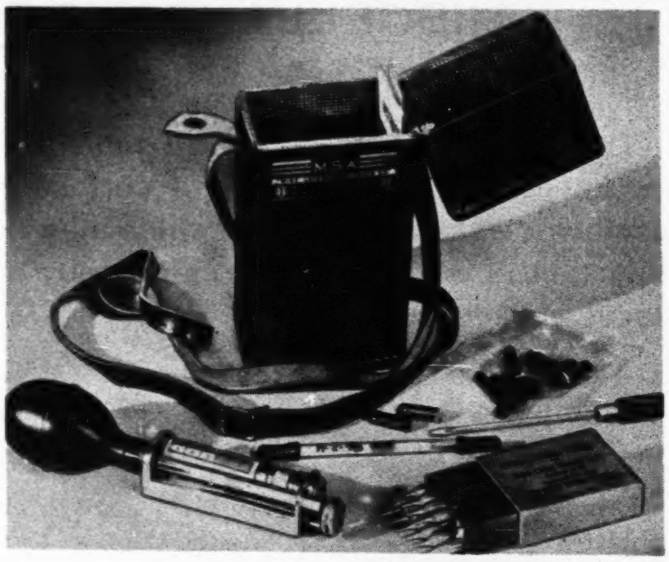
Portable oxygen indicator
  (See Figure 17)
Well-equipped tool box
Spanner wrench
Hydrant wrench
Shut-off keys (gas, water, etc.)
Lyle gun
Tool kit (small tools)
Flags and flares
Brooms and mops
Atmosphere testing equipment
Explosimeter (See Figure 18)
Carbon monoxide tester
  (See Figure 19)



Courtesy Mine Safety Appliances Co.

Figure 18

Explosimeter



Courtesy Mine Safety Appliances Co.

Figure 19

Carbon monoxide tester

SPECIAL EQUIPMENT

Some rescue operations require use of the heavy-duty mobile equipment designed for earthmoving or wrecking jobs: power shovels, scrapers, bulldozers, cranes, dump trucks, highway wreckers, etc. Specially qualified, trained men operate these machines. A squadman cannot be expected to be familiar with their use and operation, unless he is employed in these areas on a full-time basis.

It is wise to contact the owners or operators of such equipment, in the squad's area of service, asking for their cooperation in the event that a sudden emergency creates a need for their services.

In communities that maintain service departments, or where the service departments of the State, County, Township, or public utilities are available, it is well to enlist their equipment and manpower in developing a local program. This creates a sound public relations bond among all parties concerned, for the safety, good, and welfare of the citizens in the area.

The control of a cooperative rescue operation is important and must not be overlooked at the development stage. It must be established at the inception that the person who commands the department or emergency unit will have complete authority to request and command auxiliary equipment when it is needed. There is no time for "red tape" during an accident or disaster, when life depends on efficient dispatching and control of equipment.

For equipping a squad that must serve a waterfront area, see Chapter XXII.

CHAPTER III

PERSONNEL

INTRODUCTION

The successful operation of an emergency or rescue squad unit depends on every man assigned to it. Only when this is recognized and accepted can satisfaction and efficiency be obtained. The saving of life is a serious business in itself and it should be handled by trained and qualified personnel. A small amount of first aid knowledge is not enough to assure the safety and welfare of a victim, under many circumstances. It should be mandatory that only personnel who have successfully completed the Advanced First Aid Course offered by the American Red Cross, or any other similarly qualified agency, and have passed the state emergency rescue training course, be considered for this important duty.

Good public relations are extremely important in any department. The services of the squad must sell themselves through the conduct and efficiency of individual squadmen. Therefore, it is imperative that squadmen be selected with great care in order that they will obtain respect from the public. Following are more specific recommendations to be used in the selection of personnel.

QUALIFICATIONS

Note: The following items are not listed in any special order of importance. They are to be used comprehensively and collectively and will merely serve as a guide to determine the over-all capability of each person to be considered as a squadman.

1. He must have volunteered for the job. This is primarily an indication that the person wants to take part in the performance of this particular duty at his own request. As a rule, no one cares to do a job, or carry out the duties of a job, if he has a physical or mental aversion to the obligation involved.
2. He must be available. There is no point in having a man assigned to life-saving units when it may be questionable as to whether he will, or will not be in a position to respond to the alarm. For example, a man whose private work takes him out of the community would not be a good choice here. However, if there are a number of men involved in the same situation, it might be well to give some thought to the idea of organizing the personnel on a so-called day or night platoon basis. Thus squad personnel would be available on a round-the-clock basis.
3. He must be dependable. Dependability is of the utmost importance. This virtue gives assurance that the squadman will carry out assignments to the best of his ability.
4. He must have a good reputation. A person's good name and standing in public esteem must definitely fit into the analysis. This type of public work will present many delicate situations, especially when the confidence of the victim in his benefactor is sorely needed. (In short, is he a good citizen?)

5. He must present a good appearance. A slovenly, dirty and unkempt individual will immediately cause the victim, as well as the general public, to look with disfavor on his benefactor. Even a stranger, when carefully groomed, is an asset when dealing with others. Many emergency and rescue units have a type of white shop coat available to their squadmen. Such a coat is easily donned and gives the men that look of neatness and cleanliness which is always so desirable.

6. He must have a pleasant personality. Arrogance and superiority will be quickly resented. Courtesy and understanding will always open the door for a better relationship with the victim. The public will also react and cooperate more favorably when treated in a firm but courteous manner.

7. He must be cooperative. This is a characteristic which calls on a person's ability to harmonize, pull together, work shoulder to shoulder, and go along with others. It may be said that people do not think together, but under emergency situations, they should act together. There is no time for bickering at the scene of an emergency. Orders and methods must be carried out even if they are not to individual liking. As a rule the end result is the same.

8. He must be definitely interested in the job. This is fundamentally a specialized field. Consequently, there will always be new and different approaches, techniques and procedures offered on the subject. If the enthusiasm is there to learn, study, and keep abreast of the times, such an individual will definitely be an asset to the squad. Then again, it must be realized that each person's interests are different. There are many firemen who are happy just to be good firemen because they love firefighting. On the other hand, the same answer is also applicable to squadmen. Personnel once placed on emergency units often make it their life's work. Whichever job it may be, however, the deciding factor is controlled by the man's interest in the job at hand.

9. He must have initiative. The ability of a person to determine for himself what has to be done, and then having the capability of going ahead and doing it, is an important qualification in this line of work. The necessity to deal with unusual situations, conditions and circumstances, makes it imperative that squad and emergency personnel have this qualification.

10. He must be cool, level-headed and have the ability to exercise common sense. Emergency situations call upon the individual to use these qualfties because of the turmoil which exists during the time of an emergency. The situation, when handled wisely and properly, will make matters easier for everyone concerned.

11. He must have an aptitude for training. The study and training time involved in learning to be a good squadman is in substance not a long-term indoctrination of practice and knowledge. First aid and life saving courses are outlines to supply the utmost in information and training in a practical and reasonable length of time. Therefore, the ability to learn quickly and have natural talent to apply this training is an important factor in personnel selection.

12. He must have leadership ability. "As ye lead, so shall they follow", may be a safe axiom in this case. These emergency situations always call for

an immediate show of authority and command. When used wisely, this quality will make it easier to control the emergency.

13. He must be in good health and physical condition. One never knows, when responding to an emergency alarm, exactly what is involved. A man may be called upon to climb, run, dig, pull, push, etc. Therefore, it is very important that a selectee have the normal good health and recognized physical abilities to perform his duties in a manner that is not detrimental to victims, his fellow squadmen, or himself.

COMPLEMENT OF EMERGENCY AND RESCUE UNITS

Determining the number of officers and men who are to man an emergency squad is somewhat controversial. The number of squad members often is based on the size of the area served and/or the available manpower. It must be borne in mind that not all of a department's personnel should be deployed in an emergency, in view of the possibility of another call.

There are basically three different types of equipment, namely Ambulance, Light Rescue, and Heavy Rescue. These recommendations are based on the absolute minimum requirements for operating them safely and efficiently.

AMBULANCE

Officers - At least one officer, or a man in charge, must be assigned to respond to an alarm with this unit at all times.

Squadmen - A minimum of two men should be assigned to respond with the apparatus. This number can include the man as stipulated in the preceding paragraph. If, however, the department is large enough to be able to detail more than two, without sacrificing its fire fighting strength, well and good. However, in order to secure the minimum of two for response, additional personnel should be delegated and available to meet this requirement.

LIGHT RESCUE

Officers - At least one officer, or a man in charge, must be assigned to respond with the apparatus on every alarm.

Squadmen - A minimum of three men should be assigned to respond with this apparatus. This number can include the man stipulated in the preceding paragraph. As the unit will be larger and carry more life saving equipment, tools and appliances, a larger complement of men will be necessary. With this in mind, additional personnel should be delegated and available for duty.

HEAVY RESCUE

Officers - Compliance with the obligation of having a minimum of one officer with the apparatus on every alarm is recommended. As a much larger unit with more manpower is included, an appointed officer should be in command.

Squadmen - This full-scale life saving operation with large and heavy equipment, many more tools and appliances, calls for a minimum complement of five men to respond with the apparatus. This number can include the officer as stipulated in the preceding paragraph. It is imperative, however, that more men be actually assigned and delegated for duty in order to assure a minimum crew of five.

CHAPTER IV

OPERATIONS

INTRODUCTION

It is advisable to give some thought to an efficient and practical method of alerting emergency and rescue squad units. The nature of this particular operation certainly calls for a somewhat different approach than the customary notification to signify an alarm of fire.

ALERTING SYSTEM

Our goal can be achieved by keeping several factors in mind, namely (1) The emergency must be identified so that both fire-fighting and emergency personnel will immediately recognize its nature: (2) Response must be rapid, only by the personnel assigned to the rescue units; (3) Unnecessary confusion and disorder which delay response to this type of alarm must be avoided.

As a rule, in paid departments these problems are circumvented by having a coded alarm system on their fire-house bell. By merely changing the number of rings, the personnel can immediately ascertain the type of alarm, and report to the apparatus floor accordingly. The problem is not that simple in volunteer fire departments. In some cases, a siren mounted on the top of the fire station or on a nearby pole is the only type of general alarm which can be given. These are set in action by telephones, relays, or manual controls. A series of wails is emitted which signifies the alarm of fire or emergency. If, however, these wails can be controlled to definitely distinguish a difference in the nature of the alarm, our purpose is accomplished. This problem should be discussed with local agencies involved in the installation of the alerting system to determine whether or not this is possible.

An alerting system that is used by many squads today employs a transmitter and individual home receivers. A receiver is placed in the home of each squad member. The transmitter is located where the squad alarms are received. The dispatcher can immediately transmit a particular tone that opens all home receivers. The dispatcher can then alert the squad members as to the location and type of emergency.

There are many types and styles of notification systems now in operation. We recommend that a study be made of the situation from the standpoint of local needs, conditions, and circumstances. Expert advice and information will be offered by representatives of the various firms in this field.

Regardless of the kind of system which is finally selected, it is deemed advisable to give additional thought to establishing a "stand-by" routine for alarms involving only the emergency and rescue squad units. This is where the extra men mentioned in Chapter III fit into the picture. Thus, a call from the squadmen at the scene for additional equipment, apparatus, doctors, nurses, etc., can be expedited immediately, instead of going through the entire alarm routine a second time.

RESPONSE

The main concern here is to facilitate an efficient and orderly "all out" by the personnel assigned to the emergency and rescue apparatus. There is no point in cluttering highways and adding confusion to local traffic with excess private vehicles trying to reach the scene, or the apparatus headquarters. If only the members assigned to these units respond, it is apparent that many of these problems will be eliminated. In addition, valuable seconds will be saved, thus enabling the apparatus to leave the station more quickly. There is bound to be a greater degree of delay when waiting for a larger complement of personnel to arrive for duty.

Here, again, the possible need is for response by the "stand-by" or extra men assigned to these units. Their availability at headquarters in the event of additional calls on the same alarm will aid tremendously in expediting efficiently any type of emergency service.

COMMUNICATIONS

It is recommended that some type of communication system be incorporated in the over-all operation of emergency and rescue squad units. In many instances, when arriving at the scene, it is necessary to call back for additional equipment and personnel, contact the sheriff's office, call the State Highway Patrol, etc. When this can be done directly from the unit, much valuable time can be saved by squadmen. Furthermore, there is nothing more discouraging or inopportune, especially when in the public eye, than a situation in which men and equipment stand by helpessly because circumstances demand additional apparatus or manpower, and nothing can be done about getting it there. Modern emergency squads utilize two-way radio communications to a great advantage. In many cases, this equipment is installed on every emergency vehicle in operation in the department, to take care of unexpected situations.

CODING CALLS

It is a good practice to code most information transmitted over a two-way radio. This is especially true when the condition of the patient is involved. For example, if the patient's condition is critical this fact might be communicated over the radio as "code signal 95." If the patient were to hear the squadmen state that his condition was critical, it might cause his shock to become more severe.

Additional code signals can be used for many other patient conditions. These coded messages might include:

a. Have hospital prepare oxygen
b. An O.B. case
c. Condition fair
d. Condition good
e. Condition critical
f. Severe bleeding, uncontrolled

Using this type of coding, the squad can notify the dispatcher, who in turn can call the hospital to be prepared. This procedure will result in better reception of the patient at the hospital.

It must be emphasized that this system of alerting the hospital should not be abused, but used only for critical patients.

CHAPTER V

SAFE DRIVING PRACTICES

INTRODUCTION

Most drivers possess a natural inclination to drive at excessive speeds. Sound thinking should tell us it is better to drive slower, and arrive safely at a given destination, than not to arrive there at all.

When dealing with the problem of "safe speeds" vs. "excessive speeds", definite facts must be included, such as: (1) a person's physical and mental ability to drive the vehicle; (2) the condition and type of motor vehicle used; (3) the weather; (4) the road condition.

It can be said that a speed considered to be a safe speed for one driver may be an excessive speed for another. Inexperienced and excitable drivers often become overzealous, a characteristic which will cause them to drive at unreasonable and unsafe speeds.

RESPONDING TO THE EMERGENCY

DRIVER'S RESPONSIBILITY

The driver of an emergency vehicle is responsible for the safe operation of that vehicle; therefore it is necessary for him to understand the limitations involving the use of red warning lights and sirens, mounted on the emergency equipment.

RED LIGHT

The flashing red light is of more value as a warning device to oncoming traffic than it is when used to alert drivers of vehicles being approached from the rear. When no visual obstruction exists, a red flasher-light mounted on the emergency unit is often more effective than a siren as a warning device, because it can attract the attention of oncoming drivers from a greater distance straight ahead. A small red light is ineffective.

SIREN

The siren is an excellent warning device, but it too has limitations caused by high noise levels, closed automobile windows, and the fact that sound waves created by a vehicle-mounted siren are directional. In certain instances, test results proved that the sounds could be heard approximately three times as far to the front as was possible to either side or to the rear. When ideal conditions prevail, a person with normal hearing and seated in an automobile with only the driver's window open, will hear the siren at a position approximately 1,000 feet to the front of the emergency vehicle. This distance, of course, is subject to changes due to the variation of street noises from trucks, buses, and other sound-producing obstacles. However, the approximate distance that the sound waves of a siren may be heard is reduced roughly by two-thirds when the listener's position is at right angles to the path of the emergency vehicle.

There are also some techniques and precautions which, if observed, will result in a more effective use of the siren and reduce the danger of accidents to emergency vehicles.

When the siren is not automatically controlled, it should be turned on and off alternately in such a manner as to utilize the full range of sound from the lower to the highest pitch. The varying sound pitch will attract attention more effectively. Many persons are deaf to high or low pitches but can hear other tones adequately.

In some states totally deaf persons are issued driving licenses. This is true in Ohio.

DRIVING AN EMERGENCY VEHICLE

The driver of any emergency vehicle cannot depend on the flashing of the red light or the sound from a siren on the emergency vehicle to guarantee safe passage or "right of way" through any intersecting street or cross roads. There is a greater danger of accidents at intersections where traffic control lights are in operation than at intersections with "Stop" or "Yield Right of Way" signs, or where intersections have no controls at all.

The public has a right to expect the emergency siren to be used only when a genuine emergency exists. The use of the siren for escorts of distinguished persons, caravans, parades, and other non-emergency uses can lead to resentment and eventual disregard. These practices are becoming less prevalent. They should be not only discouraged but prohibited.

To gain the "right of way" over other vehicles traveling in the same direction, a siren should be actuated sufficiently in advance before overtaking the vehicle so that the driver will have had adequate warning of the approach. The sudden use of a siren immediately behind another vehicle may cause an excited motorist to stop suddenly or swerve so abruptly that his car may be struck by the emergency vehicle, or possibly it may strike other automobiles or pedestrians.

When an emergency vehicle is preparing to pass another vehicle, it must be done with caution, especially when it is necessary to drive across the center line of the roadway. In such cases when a motorist is alerted to the situation he should, if possible, drive to the nearest curb or roadway limit and stop. Such results cannot be expected from all motorists in all situations; therefore, the safety of these people rests in the hands of the emergency unit driver.

No emergency vehicle should pass another emergency vehicle while responding to an alarm except when an "all clear" signal has been received from the driver or the officer in charge of the first vehicle, and then only when in the judgment of the second vehicle's driver it is safe to proceed. A safe distance of five hundred feet should be maintained between emergency vehicles when two or more units are responding together to the same alarm.

The careful selection of sound-thinking and intelligent drivers, properly trained, will help solve this problem; however, it is essential that all drivers understand speed in relation to "reaction distance", "braking distance", and "stopping distance", explained herein:

Speed: The miles per hour a vehicle travels.

Reaction Distance: The distance a vehicle will travel while a driver is transferring his foot from the accelerator to the brake pedal after he perceives danger.

Braking Distance: The distance a vehicle will travel from the place where the first application of the brake was made to the place where the vehicle stopped.

Stopping Distance: The sum of the reaction distance plus the braking distance

These distances will vary due to the physical and mental alertness of the driver, the speed, type and condition of the vehicle, the number, type and condition of the brakes, the tire sizes, and the weight of the vehicle when fully equipped, plus the type and condition of the road surface.

For example, at 40 m.p.h. a vehicle is traveling approximately 59 feet per second This requires a distance of 44 feet (reaction distance) for the average driver to react and apply the brakes. In most cases the vehicle will have traveled an additional 88 feet (braking distance) before it stops. This adds up to a total of 132 feet (stopping distance) which is the approximate total number of feet required to halt the vehicle. At speeds lower than 40 m.p.h., it is possible to control the apparatus with some degree of safety. With higher speeds, such as 60 m.p.h., the stopping distance increases to an approximate 264 feet.

Drivers should remember that they are responsible for the lives of their fellow squadmen, the victims, and others.*

TRANSPORTING VICTIM TO THE HOSPITAL

Few, if any, emergencies require the need for excessive road speeds when transporting the victim. Along with this, poor driving practices such as swerving, fast turns, and sudden changes often increase the extent of the injury and create an adverse effect on the victim. This action is improper in all respects.

Another major danger associated with a speeding or carelessly operated rescue squad vehicle is the possibility of being in a traffic accident. Such a situation would cause a delay in assisting those involved in the original emergency, plus the possibility of obtaining more victims and often destroying services for which the rescue vehicle was purchased.

The safe speed for any emergency run must be established while the run is being made, and it must be based on the weather, streets, traffic, the driver, and the victim's condition. Because of the seriousness of this situation, there must be adequate planning and wholehearted cooperation of all persons concerned in order to make any rescue squad a successful operating unit.

---

* Chapter XXVI covers legal aspects of operating emergency vehicles in more detail.

CHAPTER VI

CONTROLLING THE SITUATION

INTRODUCTION

A squadman's first responsibility in any emergency is to the victim. However, since squadmen are often the first trained personnel to arrive at an emergency, it is sometimes necessary for them to do other things which are not, strictly speaking, victim care, in order to perform their function adequately without endangering their own safety and the safety of others.

HIGHWAY ACCIDENTS

In certain situations a victim should receive "on the spot" emergency care before being moved for any purpose. Often immediate assistance to a highway victim is essential before adequate warning signals are set out to alert oncoming traffic. In such instances, the warning lights on the rescue vehicles can be used to excellent advantage. They will provide some protection to the victim and the squad personnel against injuries or death. When it is permissible to move a victim safely a short distance from the danger zone, the traffic situation will be less serious. The procedure to follow must be decided for each individual case by the squadman-in-charge at the accident. Squadmen should not deviate from the "victim care", outlined elsewhere in this manual, when considering whether to move the victim to safer area.

Unless some plan of action is set up, practiced, and understood by squad personnel, there may be confusion at the scene of a highway emergency. Figure 1 shows efficient, pre-planned handling of a highway accident.

FLAGS AND FLARES

Section 4513.28 R. C. of Ohio states that in case of a highway emergency, warning signals shall be placed forty paces or approximately one hundred feet both to the front and to the rear of the vehicle.

If the spot of emergency is near a curve, crest of a hill, or place where the vision of oncoming traffic may be obstructed, the warning signals should be placed to give ample warning.

This code directs all emergency squad units to provide for the protection of all persons directly or indirectly concerned with highway emergencies. These warning devices must be used with due regard for the common hazards each may present in a particular situation. For example, open flames, lights, or non-vapor-proof lanterns must not be used in an area filled with gasoline or other flammable vapors.

When the job of caring for the victim demands the squad members' entire personal attention, it is then necessary for the squadman in charge to direct some other person to set out whatever signaling device is suitable for the existing condition.

CLEAN - UP

The Ohio Driver's Manual states, "Any person removing a wrecked or damaged vehicle from a highway shall remove any glass or other injurious substance dropped upon the highway from such vehicle."

The above quotation is not to imply that the rescue squad members are responsible for the removal of such substances dropped upon the highway, but rather to point out with whom this responsibility lies. Some of the most common substances found in a clean-up situation are:

Gasoline: This must be flushed from the highway with large quantities of water. Consideration must be given to where the gasoline and water will run and what additional action, if any, is necessary. For example: Should the gasoline be flushed to a nearby creek, what are the potential dangers and what lies within its path? When the gasoline is flushed into a sewerage system that leads to a sewage disposal plant, the person on duty at the disposal plant should be notified immediately. When it is flushed into a sewerage system in a closely populated area, it is wise to inspect these buildings for gasoline fumes and advise the occupants to discharge water into their floor drains to assure having adequate water in the "trap". This will close off a drain and lock the fumes out of a house.

Both a powder and a liquid are available for use on gasoline to reduce the fire danger. The powder is spread on the gasoline and then flushed with water. The liquid is sprayed over the gasoline and then flushed away. Either of these materials will make a nonflammable emulsion that is easily flushed away.

Glass: Broken glass in most cases presents no special hazard in having it removed from the highway but, as in many other highway situations, a constant watch for approaching vehicles must be maintained. A reasonable signal such as those previously mentioned should be given in advance to stop or slow down the traffic, to prevent injury or possible death to members of the clean-up crew.

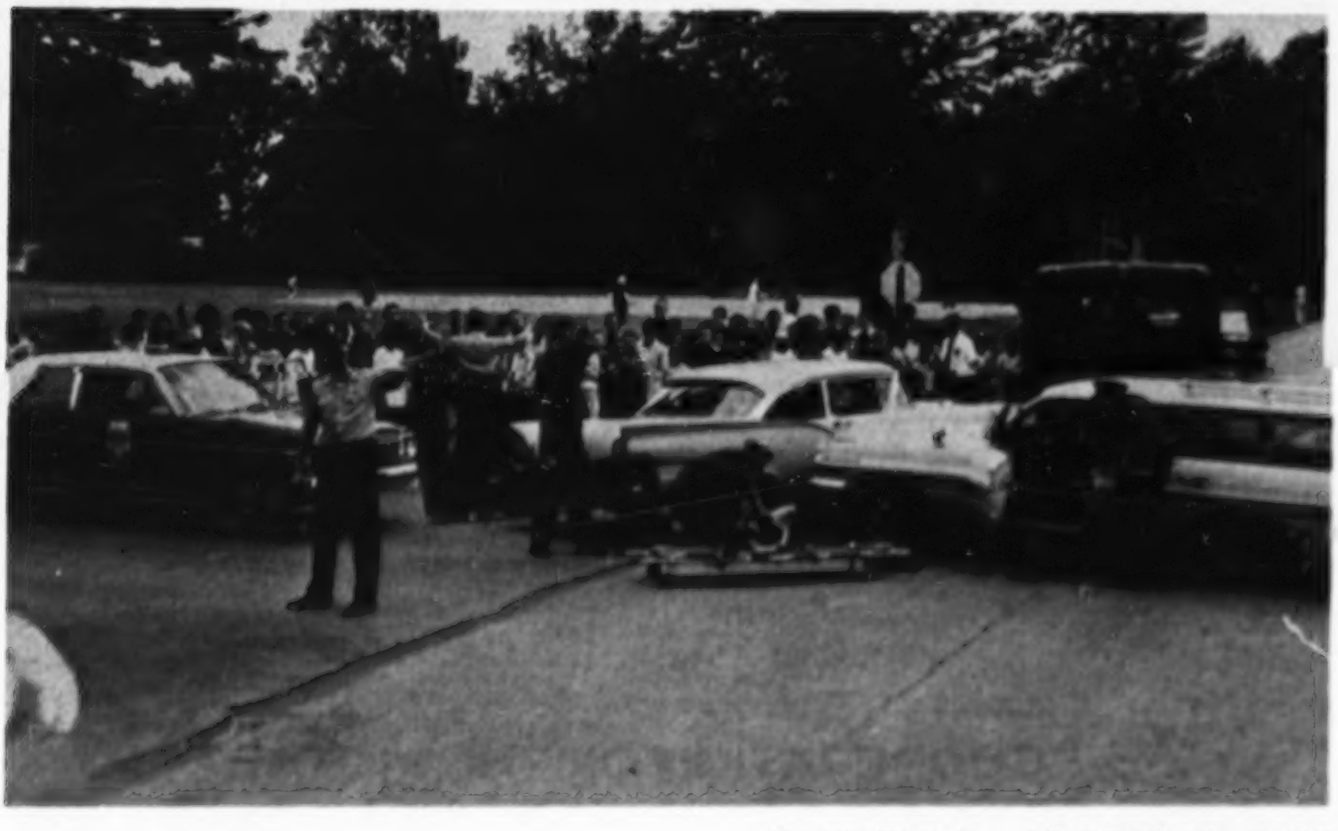
Blood: This provides a somewhat different problem than that encountered in similar situations. Removing the blood from the highway is a simple operation when done by flushing. But the difficulty arises when a "weak-stomached person" is an unwanted spectator who must get all the details first hand. Then just about the time the job is completed, this person "passes out" and a new problem is encountered.

Miscellaneous Situations: There are numerous situations that could be described here, such as one where a large milk supply transport truck overturned and spilled the entire contents over the highway. Another is where a farm produce truck was involved in an accident and most of the contents were distributed across the highway. Regardless of the situation there are many factors to be considered, such as the substance involved, where it occurred, and how it can be corrected. Weather conditions also play an active part in deciding on a course of action. During freezing weather a method not involving water may be necessary. But when water is necessary to do the job, a supply of salt, sand or other like substance may be needed to make the area safe for both motorists and pedestrians. This, as previously stated, is not a direct function of a rescue squad but it is their responsibility to request assistance through certain local authorities by stating the need for additional personnel and supplies.

COOPERATION BY PREPLANNING

A rescue squad will, in many cases, request cooperation from the local police department, county sheriff's office, State Highway Patrol, and the highway department. Rescue squad personnel should attend to the emergency as it concerns first-aid and rescue, and let the law enforcement agency handle the other people and traffic problems.

Rescue squad personnel supervisors should seek cooperation through preplanning with the local police, county sheriff, State Highway Patrol and the highway department. Each has a definite place and each group should cooperate with the other to develop a plan, before the emergency rather than at the scene of the emergency. To best accomplish the desired cooperation, it is suggested planning be done with the top officials of the organizations concerned. At this level, definite agreement can be made which will not be contradicted later. (See Figure 1.)



Courtesy Sharon Twp. F.D. & Worthington, O., P.D.

Figure 1

Cooperation at an accident scene. The police agency was notified of the accident and requested an emergency squad to respond. At the scene, the victims are being cared for by the squadmen while police officers are controlling the bystanders and traffic. Note that one squadman is examining a victim on the road and another is examining a victim in the car. The other squadmen are preparing equipment that probably will be needed. Only by good preplanning between the squad officers and the local police agencies will such effective handling of an accident be possible.

HOME SITUATIONS

Squadmen must have the ability to handle the relatives and friends of the victim, to the end that they will not interfere with the victim's care or the squadmen. This responsibility might be delegated to one member of the squad while the others proceed with the care of the victim. Hysterical mothers, wives, sisters, and grandmothers always create an added problem for the squadmen. This problem is important and in some cases must be eliminated before the squadmen can give attention to the victim. If this problem is not eliminated, it is very possible to have two victims in place of one. There is no set rule for the squadmen to use to cope with this problem; however, the following situation will present an example which may be helpful.

EXAMPLE

Husband has heart attack. His wife is hysterical.

PROCEDURE

1. Take wife to another room.
2. Ask her questions, to keep her mind occupied.
    a. Has your husband had these attacks before?
    b. Is he taking medicine? (If so, ask to see it.)
    c. What is his medical background?
    d. Who is his doctor?
    e. What is his parents' medical background?
    f. How many children do you have?
    g. How old are they and are they away? (Army, college, etc.)
    h. What is your husband's age?

Little help will be required by the relative who remains calm in the face of an emergency; however, a word of sympathy and encouragement is well worth while.

Do not blame or ridicule a person for feeling as he does. Your job is to help him cope with his feeling.

COOPERATION OF THE VICTIM

Every effort must be made to secure the cooperation of the victim. Often a problem is the additional embarrassment to the victim caused by curious bystanders. It is to the best interest of the squad and the victim to protect the victim from these prying eyes.

For example, if a woman should break her leg in a crowded area, she should be covered with a blanket. The examination should be made and the splint put in place by feeling under the blanket. With practice, this can be readily accomplished.

If possible, the area in which the victim or victims are located should be blocked off and shielded from the sight of onlookers.

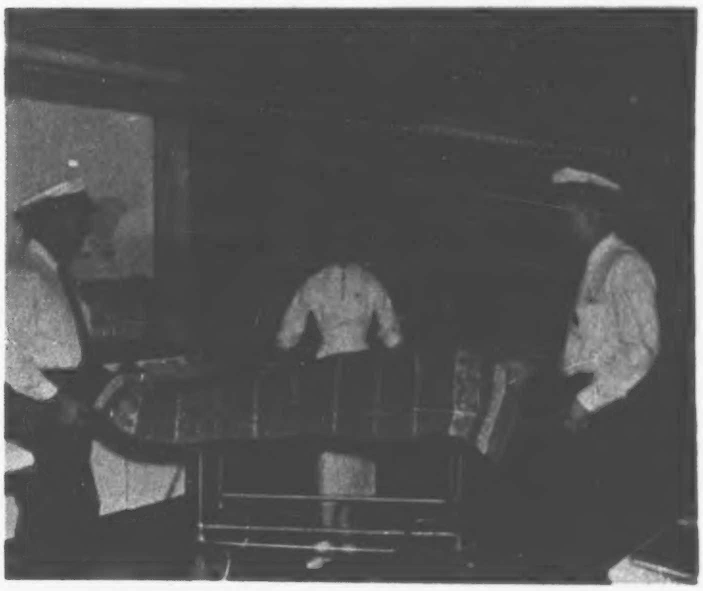
COOPERATION WITH HOSPITAL PERSONNEL

Giving the best possible care to victims is of primary importance in emergency squad work. One means of doing this is to establish good relationships with the hospital personnel with which the squadmen come in contact, and most especially the emergency-room personnel.

If there is a working agreement between the emergency squad and the regular personnel in the emergency room, the care of the patient from the time he is seen by the squadmen until the time he is admitted to the hospital will not be disrupted. This can only be accomplished if all people who come in contact with the patient work as a team.

The officer in charge of the emergency squad or the chief of the department should meet periodically with the supervisors of the emergency rooms with which his squad comes in contact. This will lead to a better understanding of the objectives of both groups. The emergency-room supervisors are most willing to cooperate with those who transport victims to the hospital.

Figures 2 and 3 and their captions show how squadmen can bring about good rapport with emergency-room personnel.



Courtesy St. Anthony Hosp.

Figure 2

Upon arrival at the hospital emergency room, tell the nurse just what type of emergency you have and the suspected injuries. In the above case, the victim has a suspected fracture. He is left on the backboard and placed on a movable stretcher. Good rapport with the 'entire team' means working well with all who come in contact with the victim, especially the emergency room personnel.

Courtesy St. Anthony Hosp.

Figure 3

After the victim is made as comfortable as possible and after any lifesaving procedures are carried out, squadmen should give the emergency room nurses all possible information:

1. The exact location from which victim was taken.
2. The type of accident.
3. The victim's condition from the time squadmen arrived until victim arrived at hospital.
4. The care given by the squad.
5. Whether the proper law enforcement agencies were notified.

CHAPTER VII

CHILDBIRTH

INTRODUCTION

A growing problem confronting the emergency and rescue squad service is emergency childbirth. The squadmen often have to decide whether to transport the expectant mother to where medical help is available, or whether to keep the mother in her home and attend the birth of the child. Because squadmen must solve this problem, it is of the utmost importance that all squadmen have at least some fundamental knowledge about the conditions surrounding childbirth.

NORMAL DELIVERIES

A woman in labor and/or a new-born child can certainly present many difficult situations. Unless the squadmen have proper knowledge and training in this particular area of emergency care, great harm may be done to the mother and/or the child.

Although it is not the intention of this book to perfect the squadmen in the art and science of obstetrics, there is a real need to give such personnel a working knowledge of what to expect. Because lives may be in the balance, the squadmen must decide quickly either to transport or not to transport a mother to a hospital. The decision should depend upon certain evidence which the squadman has to evaluate at once.

The expectant mother is to be transported only before the evidence of crowning is apparent. If crowning is apparent, childbirth will follow soon after. In such a case, the mother should not be moved at all, unless the squadmen are otherwise directed by a physician.

The squadmen must have some concept of what takes place before, during, and after labor to be able to best care for the mother and child. However, this material will deal mainly with the period during labor since this is usually the period in which victim care arises. Therefore, the squadmen should have some knowledge of what is normal and abnormal in childbirth.

DEFINITIONS

Obstetrics: The care of the childbearing woman and her new-born baby. Obstetrics deals basically with three distinct periods:

1. Pregnancy: The period from conception through the period of labor to birth of the child.
2. Labor: The period during which the baby and the placenta are expelled from the mother's body into the outside world.
3. The Puerperium (Post Delivery): The period during which the organs of reproduction are restored to approximately their former size and condition. This usually takes about six weeks.

Internal Organs: The internal organs of reproduction are: (a) the ovaries, (b) the fallopian tubes, (c) the uterus, and (d) the vagina.

Ovaries: The ovaries are the glands in the female producing the reproduction cell known as the ovum.

Fallopian Tubes: The fallopian tubes are two thin, trumpet-shaped, flexible muscular tubes, about four and one half inches long and somewhat thinner than a lead pencil. They have two openings, one into the uterine cavity and the other into the abdominal cavity. The abdominal opening is somewhat larger and is surrounded by a large number of fringes; hence the term "fimbriated end". The fallopian tubes act as a passage from the ovaries to the uterus.

Uterus: The uterus, or womb, is a thick-walled, muscular, hollow, pear-shaped organ. Fully developed, in nonpregnant state, it is approximately three inches long, two inches wide, one inch in thickness, and weighs from one to two ounces. It is composed of involuntary muscle fibers, running in different directions, making its expansion possible up to the size of a pumpkin. At termination of pregnancy it weighs about two pounds. The muscles of this organ are arranged so as to make it able to expel its fetus (infant) by contraction at the termination of normal labor. (See Figure 1.)

Amnion (Bag of Waters): The thin transparent sac which holds the fetus suspended in the fluid called amniotic fluid. This sac is lined with a smooth, slippery, glistening membrane. The space, or the amniotic cavity filled with fluid, is often called "the bag of waters." Here is where the child floats and moves. At full-term pregnancy this cavity normally contains from one half to one quart of water. The important functions of this fluid are:

1. To protect the fetus from blows
2. To allow the fetus freedom of motion
3. To keep the child at an even temperature
4. To help to enlarge the vaginal canal during labor so the child may be born more easily.
5. When membranes rupture, to flush the birth canal, thereby cleansing, lubricating, and disinfecting it

Placenta (Afterbirth): By the third month another important structure, the placenta, has formed. The placenta is a fleshy, dish-like organ. Late in pregnancy it measures about eight inches in diameter and one inch in thickness. It receives its name from a Latin word meaning cake, which this structure resembles somewhat in shape.

A tree or a plant sends its roots into a bed of earth for nourishment, and when the plant is removed a certain amount of the earthy bed clings to the interlocking roots.

Similarly, a thin layer of the uterine bed clings to the branching projections and together they make up this organ, which supplies food to the fetus as the roots and the earth provide nourishment for a plant. At term a placenta weighs about one pound. Its surface is smooth and glistening, and beneath this membrane may be seen a number of large blood vessels.

The placenta and the child are connected by means of the umbilical cord. This cord is fastened to the center of the placenta and from there enters the abdominal wall of the child. It is usually about twenty inches in length and three quarters of an inch in diameter. It contains two arteries and one large vein, which are twisted upon each other and are protected from pressure by a transparent, bluish-white, gelatinous substance called jelly.

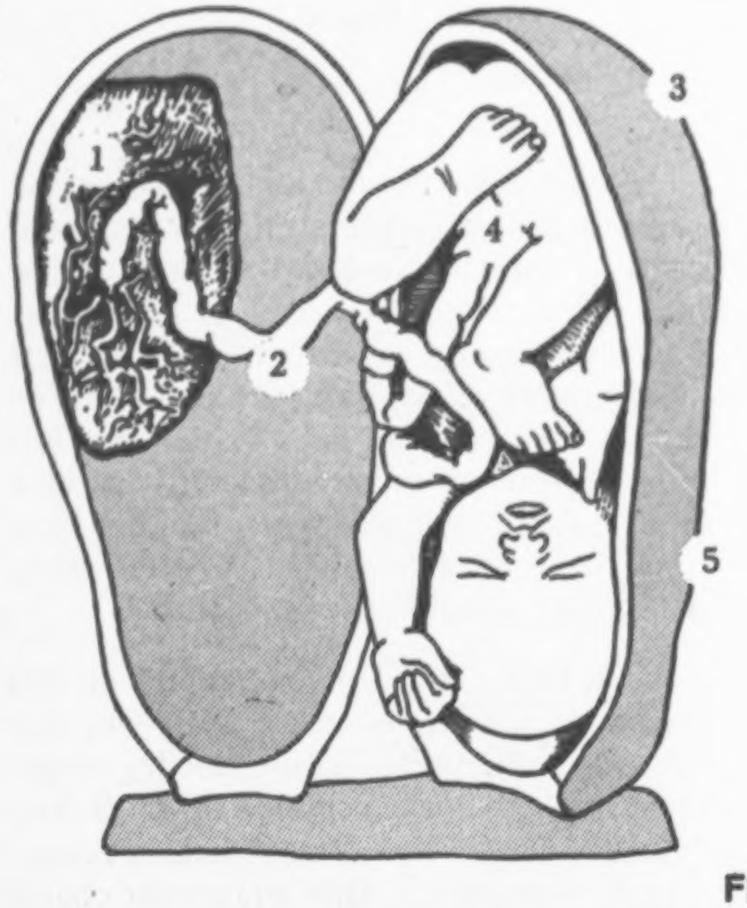
LABOR

Labor is the process by which the child is expelled from the uterus. It is divided into three stages: dilation, expulsion, and placental.

First Stage - The first stage of labor (dilating stage) begins with the first symptoms of true labor and ends with the complete dilation of the vaginal canal.

Squadmen's Care

1. Encourage the victim. The squadman should display an attitude of cheerfulness, sympathy, and encouragement toward the expectant mother.
2. Observe the character of the pains. The frequency, the duration, and the intensity of the pains should be watched closely and recorded. The presence of "show" in substantial amounts (bloodstained



1. Placenta: usually attached on rear wall
2. Umbilical cord: it is about 20 inches long
3. Fundus of uterus
4. Infant's navel
5. Front wall of uterus

Figure 1

Unborn child

mucus, not actual bleeding) suggests that rather rapid progress may be taking place and should be reported, particularly if associated with frequent severe pains.

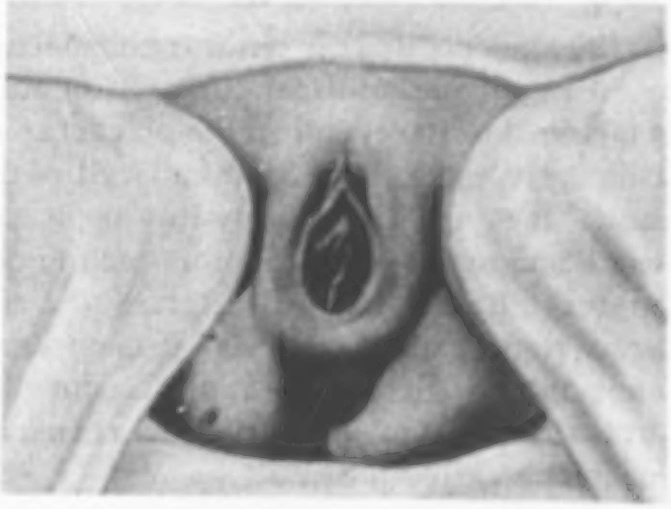
3. Urge the victim not to bear down. During the first stage of labor, uterine contractions are involuntary and uncontrolled by the victim. Not only is it futile for her to bear down, this leads to exhaustion and may tear parts of the birth canal.

If the squadman determines that the mother is in the first stage of labor, preparations should be made to transport her to the hospital.

Second Stage - Watch for signs of the second stage. These signs are as follows:

1. The victim begins to bear down on her own accord.
2. There is a sudden increase in vaginal discharges; sometimes there may be slight actual bleeding. This indicates that the child's head is passing through the completely dilated birth canal.
3. The victim thinks that she needs to evacuate; this symptom is due to pressure of the head on the perineal floor and consequently against the rectum.
4. The membrane ruptures with discharge of fluid. This, of course, may take place at any time but occurs most frequently at the beginning of the second stage.
5. The vaginal opening begins to bulge and the anal orifice to dilate. This is a late sign, but if 1, 2, 3, and 4 occur, the appearance of the infant should be watched for, with every pain. Only the appearance of the head (crowning) can definitely confirm this suspicion. Vomiting at this time is not unusual. If vomiting occurs, take precautions against strangulation.

Crowning - The vaginal opening will bulge and the top of the child's head will actually be seen. This is called crowning. Crowning is the very last symptom before the head and then the child are actually delivered. (See Figure 2.)



Courtesy After Bumm, Robert L. Dickinson, M.D.

Figure 2

Crowning

If examination of the birth canal during labor pain reveals that the mother is crowning, this will indicate that the infant may be born almost immediately. In this case, squadmen should not attempt to transport the mother to a hospital, but should be prepared to deliver the baby in the next few minutes. If she is not crowning during a labor pain, squadmen will probably have time to reach a hospital. In such case, the mother should be transported.

Care at Delivery - If it is established that the squad must help in the delivery, one squadman should obtain the following equipment from the squad vehicle: (a) O. B. kit, (b) first aid kit, (c) combination resuscitator-aspirator. This equipment should be brought to the delivery area and made ready. (See Figures 3A and 3B.)

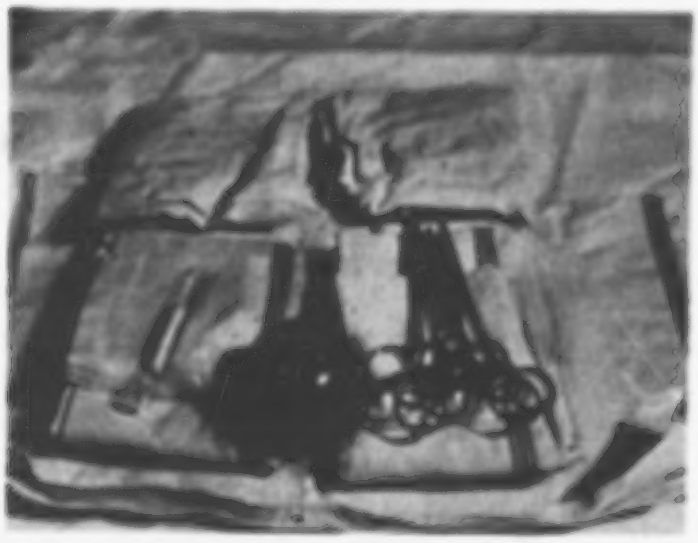


Figure 3A

An open O.B. kit. The gloves (in the back) are separate so that the squadmen may put them on without contaminating the other sterile materials.

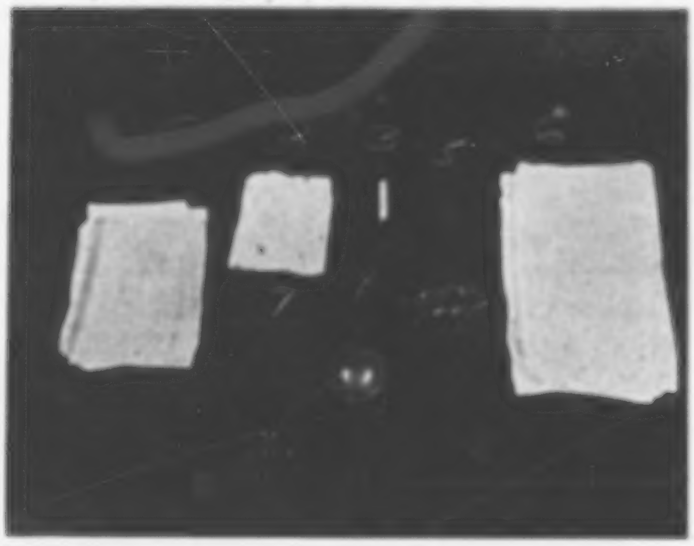


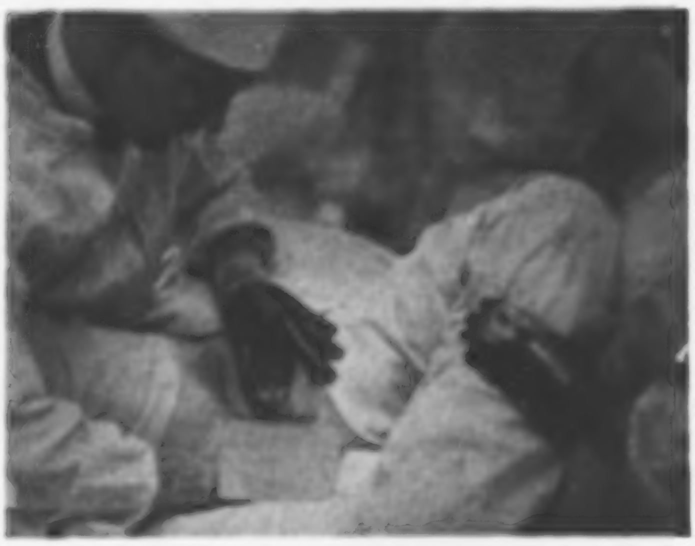
Figure 3B

Materials needed in an O.B. pack:

1. 4 towels
2. 12 gauze compresses, 4 x 4 size
3. cord tape or ties
4. soft rubber ear syringe
5. 4 large, straight hemostats
6. 3 pairs of rubber gloves
7. 1 pair of scissors

Towels are used to protect the area. The 4 x 4 compresses are used to absorb any liquid materials. The ear syringe is used to suction the child's nose and mouth.

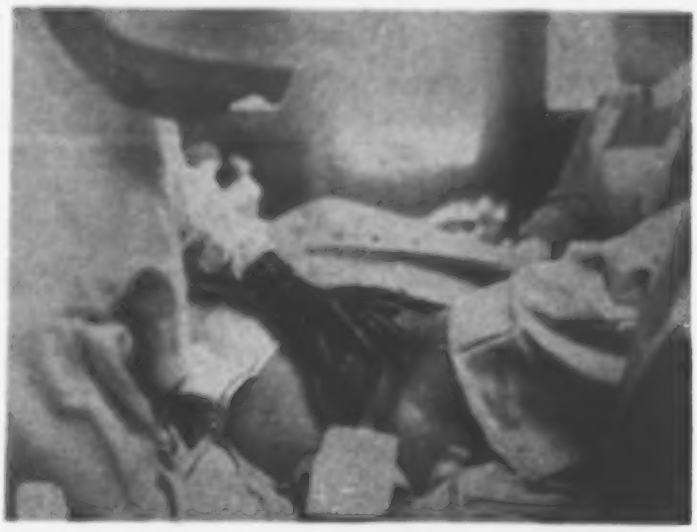
Figures 4 through 9 show stages in the normal delivery of an infant's head. The head usually is delivered with the face toward one of the mother's legs. It should be supported by the rubber-gloved hand of a squadman. Gloves should be sterile if possible.



Courtesy Dr. George P. Shears

Figure 4

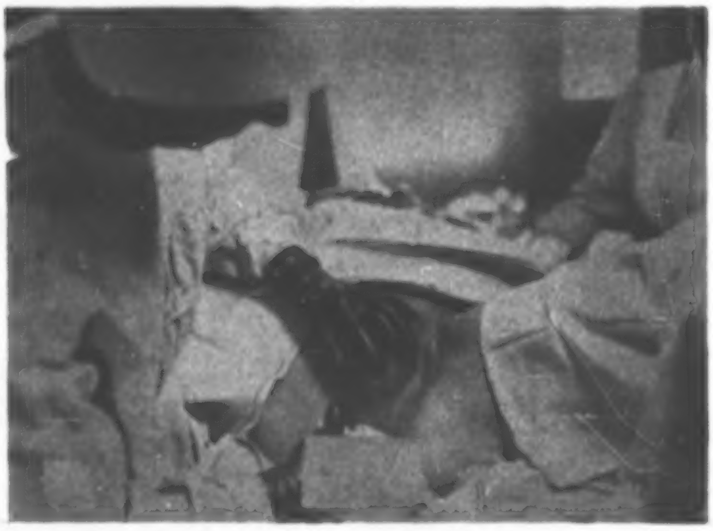
Crowning has occurred; delivery is starting.



Courtesy Dr. George P. Shears

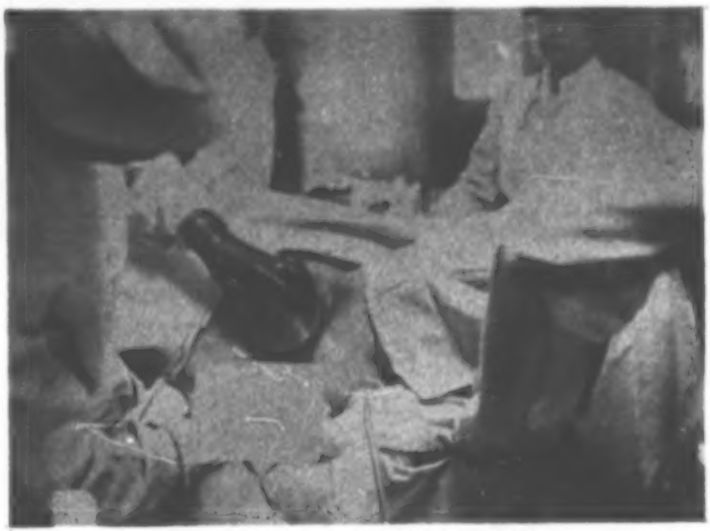
Figure 5

This is a normal presentation.



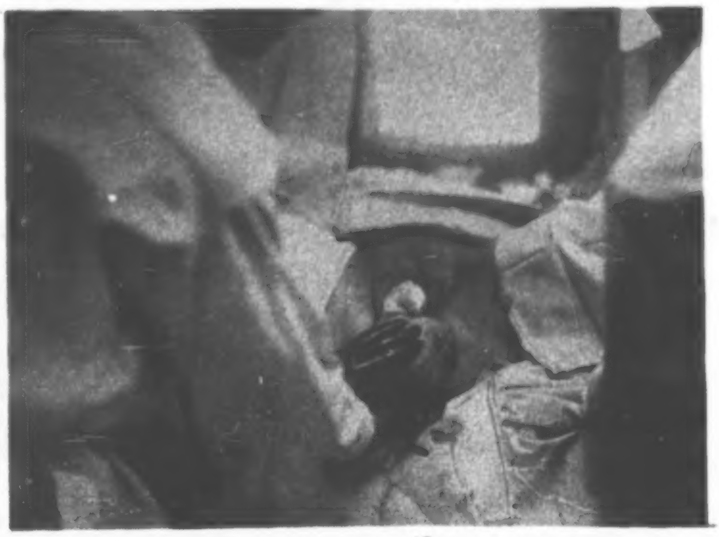
Courtesy Dr. George P. Shears

Figure 6



Courtesy Dr. George P. Shears

Figure 7



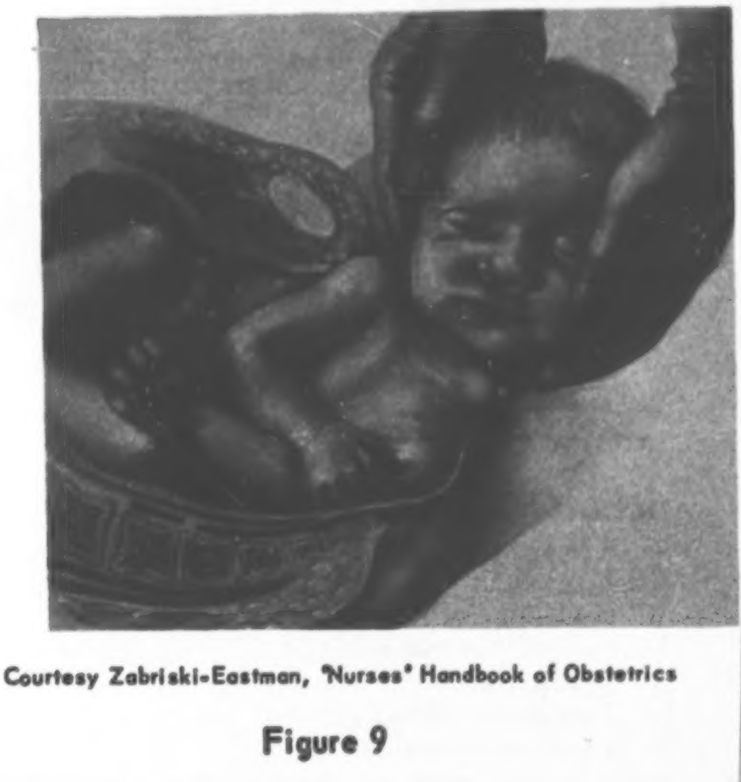
Courtesy Dr. George P. Shears

Figure 8

Be prepared to support the baby's head as soon as it is delivered.

While supporting the head, check to find out if the cord is wrapped around the neck. If it is, run your finger between the cord and the child's neck to loosen the cord. If the cord is too tight, clamp it twice and cut between clamps.

After the head is delivered, contraction of the uterus will continue until the shoulders are delivered. Do not pull. The mother sometimes has difficulty delivering the shoulders because of their width. The top shoulder is usually the first one to present itself. Slight traction on the head toward the floor will help deliver the upper shoulder: see Figure 8. Slight traction on the head toward the ceiling will help deliver the bottom shoulder: see Figure 9. Then apply slow, straight outward traction very gently on the head. Continue to support the child and be ready for sudden expulsion. After both shoulders are delivered, the baby will follow very quickly. Guard the cord so as not to tear it.



Courtesy Zabriski-Eastman, "Nurses" Handbook of Obstetrics

Figure 9

Delivery of bottom shoulder. Note that sterile gloves are worn.

Care of the Child - The child is now on his own and should be able to start to breathe. To safeguard the child, the squadmen should:

1. Turn the child on his side across the mother's abdomen. This will facilitate the flow of mucus out of his mouth.

2. Pull the tongue forward. This can be done by grasping the tongue, top and bottom, and pulling out to the lower lip.

3. Clear his air passage. Wipe his mouth inside and out with a gauze bandage (4 x 4). By placing another gauze compress (4 x 4) over your index finger and placing your finger in the child's mouth, gently clean out all foreign bodies and mucus.

All three of the above should be carried out in all deliveries whether the child breathes immediately or not.

4. If the child starts to breathe, your attentions should then be turned to the mother and the cord.

IF THE NEWBORN DOES NOT BREATHE-

If 30 seconds to one minute have elapsed without the newborn breathing, and steps 1, 2, and 3 above have been completed, the squadman must start some type of resuscitation.

5. Stimulate the child. This can be done by rubbing the child with your hand. Do not slap the child. You may also snap him on the bottom of his feet with your index finger. The child should be left on his side for this.

6. Use manual artificial respiration. Leave him on his side and aerate him by mouth-to-mouth breathing. This should be done once or twice. If the child is able to breathe on his own he will. If he does not:

7. Use mechanical artificial respiration. This is done by using a commercial resuscitator. Put the mask in place using the resuscitator stage of the machine. Let the machine breathe for the child once or twice and discontinue. If he is able to breathe on his own, he will. If he does not, it is evident that he is not able to do so.

8. Keep up the mechanical resuscitation. This must be kept up until the child starts to breathe or until he is pronounced dead by a physician. Transport him as soon as possible.

The Cord - After the child is breathing, attention should be turned to the cord. The squadmen need to know the procedure for cutting the cord, as a safety measure when the mother must be moved under awkward conditions. Those who have tried to carry a new mother down three flights of stairs with a newborn balanced on her abdomen know the safety problem. There are instances when the child should be separated from the mother.

1. Milking the cord - Before cutting the cord, the squadman must "milk" it. At approximately nine inches from the child, grasp the cord between index finger and thumb of one hand. With the index and second finger of the opposite hand grasp the cord in a scissors fashion. Milk the cord toward the baby for only two inches. It is in these two inches that the cord will be cut.

2. Tying the cord - Place a sterile clamp (hemostat or tie) approximately six to nine inches from the baby's abdomen. Cord ties can be purchased through drug stores or hospital supply companies. Each tie is 1/8" x 12". Ties are made of cotton and can be purchased sterile.

Approximately one inch further away from the tie or clamp, place another tie or clamp. When tying the cord, use square knots and put at least three knots in place.

3. Cutting the cord - Between these two clamps or ties, cut the cord with sterile scissors. This physically separates the living and breathing child from the mother.

Put the child in a soft blanket and place him in the care of some competent person. The child should be kept on his side with his head slightly lower than his body.

The emergency squad should check with local physicians as to the desired procedure to be carried out when cutting the cord in an emergency delivery.

Third Stage - From the time the child is delivered until the placenta is delivered is the third stage of labor. The placenta usually appears within 30 minutes. There will be one to two cups of blood delivered with the placenta. This is a normal amount.

After the after-birth (or placenta) is delivered, it should be preserved in some type of container or wrapped in a newspaper. This must be kept and brought into the hospital with the mother and child, so that it can be examined to see if any particles have been left in the uterine cavity.

A sterile sanitary napkin can be placed in position at this time. Be sure it is sterile. A squad should not carry an open box of sanitary napkins and use these at this time. Individually wrapped sterile napkins should be carried. If they are included in the O. B. pack, they will be sterile.

FINAL STEPS IN EMERGENCY CHILDBIRTH

The mother and child must be in the hands of medical personnel before the squadmen leave them, for the following reasons:

1. The child must have a physical examination.
2. The mother must have a physical examination including the checking of her birth canal for lacerations.
3. The newborn's eyes must be cared for, to prevent any serious eye infection. (This is a state law in Ohio.) Silver nitrate is usually used and this function is to be performed only by the experienced and trained squadman; usually it is done by a physician.
4. The cord must be checked by competent medical personnel.
5. Baby and mother must be observed for a period of time.

If the physician should ask the squadman to make out the birth certificate, he may do so. Many times the physician may ask that this be done because the squadman was present at the actual delivery.

Birth certificates can be obtained at the local county health office. They must be made out as soon as possible after the birth and be filed with the proper registrar in the county health office.

UNUSUAL DELIVERIES

DEFINITION

The term "Breech", in connection with childbirth, refers to the birth of the infant in a reverse position, as contrasted with normal head-first delivery.

In normal childbirth, the child will usually start to breathe as soon as his chest is exposed, or shortly afterwards. Because of the nature of the breech type of birth, the child's chest is delivered before his head. It is impossible for the child to take in air, as his air passages are blocked; his head is still within the vaginal canal.

SQUADMEN'S CARE

As soon as the squadman finds that it is going to be a delivery in a breech position, he must be ready to support the child. This can be done by letting the child rest on the squadman's hand and arm, thus allowing the infant's legs to straddle the squadman's arm.

The legs, hips, stomach, and chest will be delivered at this point. Sometimes it will be harder for the mother to deliver the head, and in more severe cases, the delay is quite long. If this happens, the child may suffocate, as the result of a poor air passage.

An air passage may be created by the squadman supporting the body of the infant with one hand and inserting the index and second finger of his other hand into the vaginal canal in such a way that the palm faces the baby. He should run his fingers around the child's neck until the chin is found. At this point the two fingers should be run between the child's chin and the vaginal canal. As the child's nose is reached, the squadman should separate his fingers enough so as to run one on each side of the child's nose. When in this position the squadman's fingers should be pushed away from the infant's face, in turn, facilitating a good air-way. The squadman should keep his fingers in this position until the entire head is delivered.

This is the only time the squadman should touch the vaginal area. The squadman should have sterile gloves on for this procedure.

OTHER CHILDBIRTH EMERGENCIES

On arrival, squadmen may find that the cord, a foot, or a hand is protruding from the birth canal. Transport this mother at once, taking special care not to injure the prolapsed part. Do not try to replace the prolapsed part in the vaginal canal!

If a hand or foot is protruding, cover it with a sterile towel or as clean a piece of material as is available.

If the cord should be protruding, the child may be in danger. This danger is caused by the cord being under direct pressure due to its position between the head and the birth canal. While the cord is in this position, the child might not be receiving an adequate amount of blood and oxygen.

SQUADMEN'S CARE

Transport this mother at once! In case the cord is protruding, place the mother on her back with her hips elevated on two or three pillows or folded blankets. This will cause the child to drop a little into the uterus. If the mother can be maintained in a knee-chest position, balance supported by squadman, it is preferred to elevated-hip position. However, this is a very difficult position to maintain during transport, and special precautions must be taken to safeguard the mother if this position is used. These positions will relieve some of the direct pressure pinching the cord.

ABORTION OR MISCARRIAGE

DEFINITION

This is the giving off of the membranes and the unborn child before the child is able to live on its own. This usually occurs before twenty-eight weeks of pregnancy have passed. Such an abortion or miscarriage can take place any time between conception and the time just before the child is able to live on his own. Although the outward symptoms may vary, the following symptoms will be present.

SYMPTOMS

1. Fast pulse
2. Perspiration
3. Pallor (pale skin)
4. Weakness - inability to stand
5. Cramping pain in the abdomen
6. Moderate to severe vaginal bleeding
7. Discharge of large or small particles from the vaginal canal

In other words, there will be all the symptoms of shock, plus, in most cases, bleeding from the vagina.

SQUADMEN'S CARE

1. Place victim in shock position.
2. Conserve body heat.
3. Squadmen may moisten the patient's lips if she requests it.
4. Do not touch the vaginal area, as the victim is prone to infection.
5. Squadmen may put sterile towels or vaginal pads (sanitary napkins) at the vaginal opening.
6. Keep any particles that are discharged and take them to the hospital with you, since this fleshy material may have form.

CHAPTER VIII

COMMON SQUAD EMERGENCIES

INTRODUCTION

This chapter will deal with victim care. It is slanted specifically toward the squadmen's care of a victim, not treatment which will be given by a physician. For the most part, therefore, the material presented here presupposes that the reader has had adequate training in first aid.

The squadman's responsibility in the area of victim care is a great one. His ability to give emergency care may often mean the difference between life and death to the victims. Very difficult rescues may be in vain if adequate emergency care is not carried out during and after the rescue.

For these reasons, the material in this chapter goes far beyond that found in advanced first aid texts. Where applicable, each section follows the pattern of giving the symptoms of the condition, and the preferred squadmen's care.

The procedures given follow the recommendations of a competent medical committee which is listed in the acknowledgment pages of this book. However, if squadmen should find that local medical personnel in the area in which the squad operates recommend a different procedure, we urge that their recommendations be followed. Squadmen should take every opportunity to increase their knowledge in victim care and should rely heavily on local medical personnel for assistance in keeping up to date on the latest procedures recommended locally.

BURNS

DEFINITIONS

Burns are injuries to the skin and/or underlying tissues and may be the results of such causes as the following:

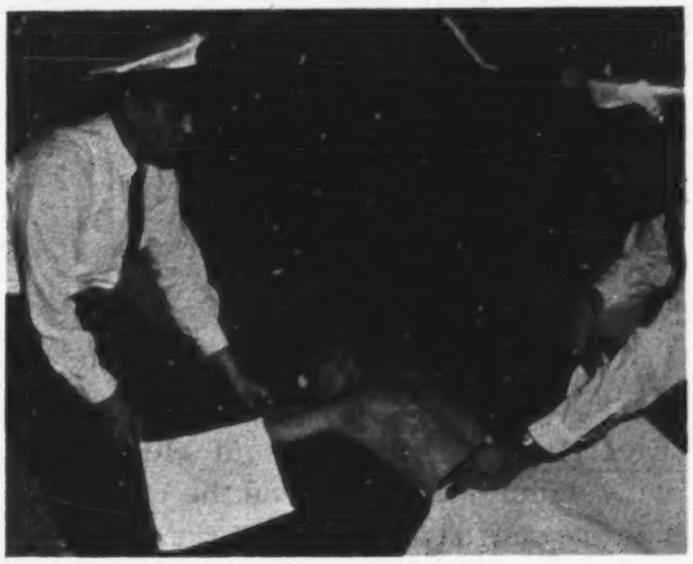
1. Heat: This may be moist (steam or boiling water) or dry, such as flame, hot metals, or hot water bottles.
2. Chemicals: Strong acids or alkalies can cause burns. Acid burns may be caused, for example, by sulfuric or nitric acid. Alkali burns may be caused by lye or caustic soda.
3. Electricity: The effects of electricity vary widely, depending on the type, the voltage and the amperage of the current. Burns are usually noted where the current enters and leaves the body. In addition to these local effects, changes may be produced in the respiratory, circulatory and central nervous system.
4. Radiation: Sources of radiation burns include ultraviolet rays, X-rays and radium. Sunburn and burns from ultraviolet lamps usually are superficial and produce short-lived effects.

CLASSIFICATION OF BURNS

First Degree: Only redness of the skin
Second Degree: Blistered tissues or destruction of the same. Blisters may be broken.
Third Degree: Charred tissues or destruction of the same.

SQUADMEN'S CARE

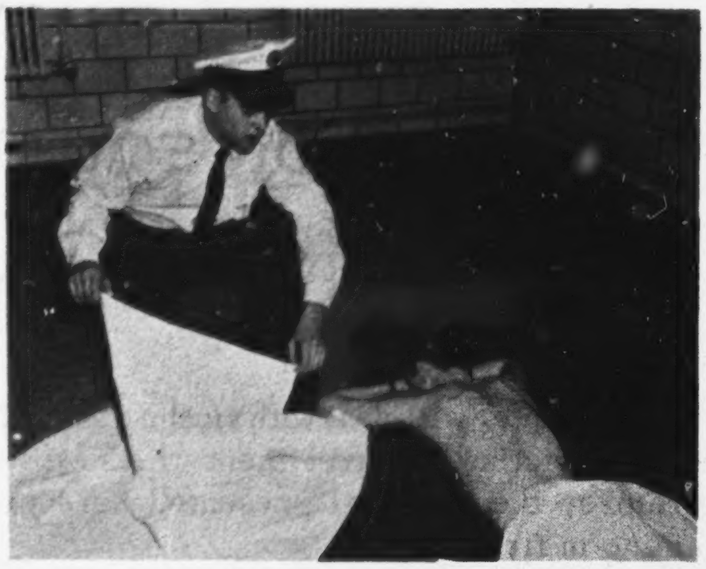
First degree - Apply a bland ointment and a snug dressing.
Second degree - Sterile dry dressing; snug bandage; do not open blisters.
Third degree - Sterile dry dressing. This can be accomplished with 4 x 4 gauze dressing kept in place by a wide roller bandage. The use of a sterile burn sheet is also indicated. (See Figures 1, 2, and 3.)



Courtesy St. Anthony Hosp. & Pleasantville F.D.

Figure 1

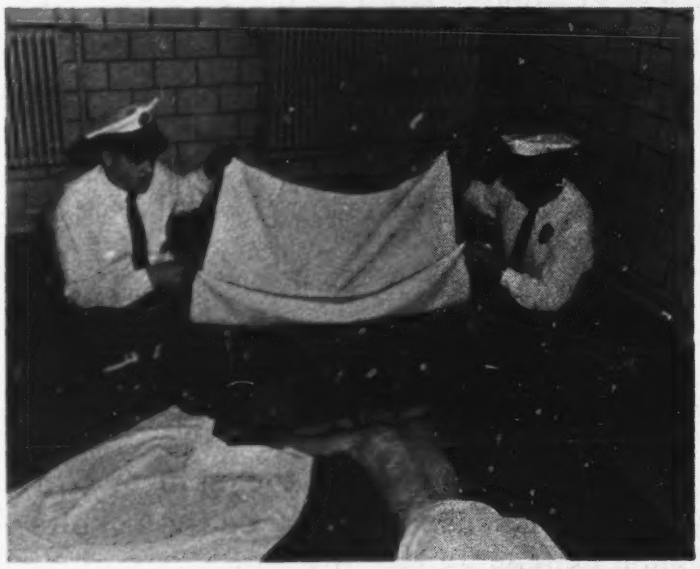
The squadmen on this call are confronted with a burn of all three degrees which involves the entire left side of the back. The victim is being treated for shock by one squadman as the other man readies the burn sheet.



Courtesy St. Anthony Hosp. & Pleasantville F.D.

Figure 2

The outside wrapper having been opened, the burn sheet is very carefully unfolded. Notice that the squadman is touching only the very corners of the sheet. This will make for a sterile area covering the burns. The sheet is handled in the same manner as when removing a sterile compress from its wrapper.



Courtesy St. Anthony Hosp. & Pleasantville F.D.

Figure 3

With the utmost care, cover the burn area and wrap the rest of the sheet around the victim. Do not use ointments or sprays of any kind on second-degree or third-degree burns.

Chemical - In most cases, dilution by flushing with large amounts of water is the best emergency care.

Electrical - Treat the local burn the same as above, depending on the degree. Watch the victim for stoppage of breathing and treat for severe shock.

Do not apply ointments to second- and third-degree burns. Remember, pain induces more shock. Physicians usually remove all ointment that has been previously applied. Removing this ointment will cause the victim to have more pain and in turn make his shock more severe.

A victim's family (or others) may apply ointment to a second- or third-degree burn before the squad arrives. If this happens, a squadman should notify the emergency room nurse as to who applied the ointment. This is important because the hospital medical team otherwise may wrongly think the ointment was applied by the squad.

If a person is burned extensively and will require surgery to dress the burns, it is wise to have his stomach empty while giving an anesthetic. So do not give liquids by mouth to a patient who has extensive burns.

The extent of a burn is estimated as a percentage of the victim's whole skin surface. The total care of a burn patient in a hospital is carried out according to the amount of the body burned.

The "Rule of Nines" is heard often in the care of burns. Figure 4 shows how the percentages are established. Squadmen should know this method so they can estimate the extent of a burn by the time the patient arrives at the hospital, and can inform emergency room personnel.

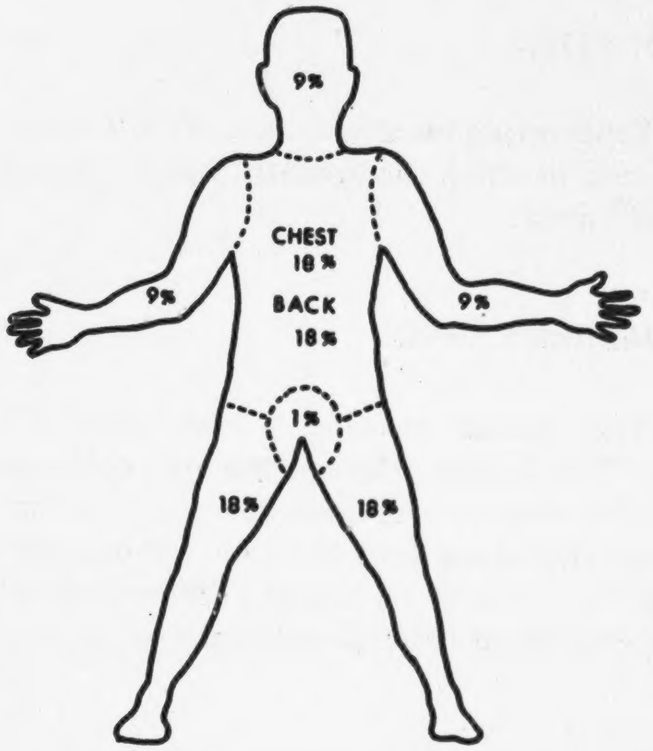


Figure 4

Body burns expressed in percentage of total skin surface.

COMPLICATIONS

The two major complications of burns are shock and infection. Shock is caused by any of the following:

1. Loss of body fluids from the denuded area. This loss is usually in the form of plasma.
2. Electricity. Brain or heart damage, seen particulary in electric shock, will disturb or destroy the breathing or blood-pressure regulating organs of the body.
3. Pain due to the burn.
4. Psychological distress.

To help prevent infection, sterile materials should be applied next to burns.

In the prevention of shock, heat is the first consideration. Conserve the victim's body heat and elevate his feet.

PENETRATING WOUNDS OF THE EYE

DEFINITION

Penetrating wounds of the eye include any wounds in which the eyeball has been cut or penetrated.

SQUADMEN'S CARE

The eyeball contains a vital fluid. If this fluid is lost, the eyeball will collapse and the victim may lose his sight in that eye. Therefore squadmen should do whatever is possible to prevent the escape of the vital fluid from an injured eye.

1. If there is an object penetrating the eyeball, do not remove it.
2. If the object is protruding from the eye, support it by wrapping and tying bandages carefully.
3. If there is no object protruding from the injured eye, cover it with a metal eye shield. Do not put compresses or cotton eye patches on the injured eye; they might cause harmful pressure.
4. Cover the good eye. This will help the victim to keep his eyes at rest.
5. Keep the victim on his back. This will help to keep the fluid in the injured eye.
6. Explain all procedures to the patient.

ABDOMINAL INJURIES

DEFINITIONS

The abdomen is the cavity in the body between the diaphragm and the pelvis. Care of abdominal injuries is usually of considerable magnitude and often requires emergency surgery. The time element between injury and operation is vital in maintaining a minimal mortality rate. This time element is called a time lag. Speed of transport to the place of definitive treatment is of utmost importance. Speed should be used, but not with lost motion or at the sacrifice of safety.

If there is a large catastrophe with many injured, transport priority should be given to the victim with an abdominal wound. Abdominal, head, and chest injuries are given priority over all other injuries, even though the patients may not appear to be seriously wounded at the time. Often the goriest of the injured or the obvious fracture are sent on, while the abdominal injury is detained. This mistake contributes to needless deaths.

SYMPTOMS

1. Shock
2. Difficult breathing
3. Protruding organs
4. Fast, weak pulse
5. Hemorrhage (arterial or venous)

EMERGENCY CARE

For protruding of the bowel or other organs through abdominal wounds, the care depends upon the facilities at hand. At the scene of the accident the care should be similar to that of a compound fracture. Do not return the organs manually, but cover them with sterile gauze or linen. If this is not available, use clean cloths.

If sterile water, plasma, or some other non-irritating sterile or "reasonably" sterile liquid is available, moisten the cloth and keep it moist. If water can be boiled for fifteen minutes, it can be used to moisten the cloths, after it returns to room temperature. If transportation will take over thirty minutes, it is worthwhile to spend the time to boil water and keep the dressing moist. The wet dressings are then covered with a large sterile (or clean) pad. This is not pulled tight, but is kept snug.

If this care is carried out in an emergency room, sterile materials will be on hand; they should and will be used. The dressings can be moistened with a sterile salt solution or sterile water. Bleeding is rarely severe and is best not cared for at a first aid station unless a spurting artery is present. More harm than good is done bv manipulation.

Time should be taken to put a compression bandage over the abdomen before transporting the victim. This can be done with the so-called scultetus or "many-tailed" binder (Figure 5).

Figure 5

The scultetus binder or many-tailed binder can be used for several kinds of emergencies.

The binder consists of a square of heavy muslin or flannel material about twelve inches square, to which a series of straps, each two inches wide and eighteen inches long, have been sewn on two opposite sides. The square is placed over the injury on top of the dressing. The straps are then alternately brought around the victim and tied. The straps are pulled snug, each strap overlapping the previous one, to hold it and the moist dressing in place. This will prevent any additional loop of intestines, or other organs, from protruding.

Binders can be made by a squad auxiliary and sterilized by a local hospital. If no binders are available, an ordinary bath towel will serve as a fairly effective substitute. The towel is placed around the abdomen, and the ends, one upon the other, are pinned loosely together.

Some kind of binder should be applied as soon as an abdominal injury is suspected by the squadman. This type of bandage also may be of service to victims who have sustained rib fractures, because it serves to immobilize the chest.

If the victim is having difficulty in breathing, he will be most comfortable in a semi-sitting position. On the other hand, if shock is present, the best position is with the head lowered and the feet elevated with knees bent. In general, if the victim's skin is dry and warm and if his pulse is strong, it is advisable to put him in a position with head and chest slightly elevated. The victim should be kept warm by the use of blankets, rather than with hot water bottles or heating pads, to prevent possible burning.

Don't give the victim anything by mouth.

In summary, we may say that the care of abdominal injuries consists of:

1. Discovering that an abdominal injury may exist
2. Caring for shock
3. Caring for any protruding organ
4. Applying moist dressing
5. Applying a snug binder
6. Securing surgical aid as rapidly as possible, by priority of transport, so that definitive care (consisting particulary of operative treatment) may be carried out.

OPEN CHEST WOUNDS

DEFINITIONS

A chest wound is any opening into the chest cavity from the outside.

CAUSES

Chest wounds may be the result of an opening caused by any object that has penetrated through the soft tissues of the chest, such as: (1) a bullet, (2) a knife, (3) any other cutting object.

SIGNS AND SYMPTOMS

In a normal chest the lung remains in a position of expansion. Any leak of air through the chest wall results in collapse of the lung. If this air pressure from the outside is not stopped as soon as possible, the lung collapse will cause the area around the heart to shift. If this shift occurs, the large blood vessels leading from the heart will be twisted, causing them to shut off the supply of blood from and to the heart. This condition can cause a type of heart failure.

A sucking sound may or may not be heard in chest wounds. These wounds are usually called "sucking chest wounds." This is because a sucking sound is sometimes made by the air rushing into the chest cavity from the outside each time the victim breathes.

These factors point out the absolute necessity for instantaneous emergency care by the squadmen in such chest wound cases.

SQUADMEN'S CARE

The squadman's first step should be to seal off the open wound to the outside air. Tape a large piece of wide adhesive over the opening. Be sure the surrounding area is well covered to prevent seepage in breathing. (All squads should carry wide tape, 4" to 6", in their supplies.)

Any non-porous material, (i.e. plastic) may be placed over the opening and sealed with tape. If the opening is large, there may be need to apply more than one piece of tape in order to close the wound completely. Have tape extend two or three inches beyond the edge of the wound on all sides. If gauze is used before taping, be sure it is large enough so that there is no danger of the gauze being sucked into the wound.

Be sure to have the victim take a deep breath before applying the tape.

Where too much time is needed to get equipment ready, the squadman should place his hand directly over the wound.

Place the victim in a sitting position if possible, or on his injured side, if nothing is protruding. Supportive treatment before and during transport is the administration of oxygen.

NOTE: If there is an open chest wound from which there protrudes a foreign object of some kind, do not remove the object.

Review of pertinent points to remember:

1. Seal the wound from the outside as quickly as possible.
2. Place the victim in a sitting position, or on his injured side.
3. Apply oxygen therapy.
4. Transport the victim to area of definitive treatment.

FRACTURES

DEFINITION

A fracture is any break in the continuity of a bone.

VARIETIES OF FRACTURES

1. The break may be incomplete with only a line in the bone. This type is frequently found in the skull.
2. The break may be part-way through the bone, splintering the fibers on one side and bending them on the other as with a green twig. This is common in children at any age where the bones are soft and pliable.
3. There may be a completely broken bone, broken transversely or in a spiral direction, and very often it is broken into several fragments.

If the fractured surfaces are protected from contamination with the outside air, or the skin remains intact, it is called a simple or closed fracture. On the other hand, if an open wound occurs at the time of the fracture so that air and bacteria may be admitted, it is called a compound or open fracture. There is a connecting wound to the outside.

A compound fracture is more difficult to treat than a simple fracture because of the open wound, since the possibility of infection must be considered as well as the fracture itself.

A complicated fracture is one in which other structures or organs such as nerves, blood vessels, joints, lungs, or bladder are injured by the force or by the fracture fragments, such as a broken rib puncturing a lung.

An impacted fracture is one in which the bone is broken and one end is wedged into the interior of the other.

SYMPTOMS

The signs and symptoms of a fracture may be visualized easily by picturing what happens when a bone is broken:

1. When a break occurs, it allows an unnatural movement of a normally rigid part.
2. The displacement of the fragments of the fracture area causes a deformity of the limb.
3. There is loss of power of movements. The limb cannot function properly because normal function of a muscle is dependent upon the bones to which it is attached.
4. Upon examination of the injured part, a grating sensation is imparted to the fingers; this is due to the rubbing of the fragments one upon the other. Correct terminology for this sign is crepitus.
5. There may be shortening of the bone at the site of the fracture.
6. Pain occurs with acute tenderness over the site of the fracture.
7. Swelling and discoloration of skin develop, due to the injury causing the fracture and the hemorrhage which follows into the tissue.

All of these symptoms are not necessarily present in every fracture. The signs observed will indicate the type of fracture present.

SQUADMEN'S CARE

The fractured part should be rendered as immobile as possible by the temporary application of well-padded splints held firmly in place by bandaging. This type of emergency care will help decrease pain and additional injury associated with a fractured bone by the immobilization of the joints above and below the fracture.

Figure 6 depicts the proper care of a patient with a severe fracture.

Courtesy Prairie Twp. F.D.

Figure 6

These squadmen are properly applying a traction splint. The patient has been treated for shock; blankets have been placed over and under her. A backboard is ready to be placed. Also, notice that a soft object has been placed under her head to make her comfortable. It is only through an examination such as that carried out in this emergency that squadmen can be sure of finding fractures.

In case regular splints are not available, other materials can be used: well-padded pieces of wood, magazines, blankets or any other materials that will immobilize the injured part. Figures 7 through 20 show various ways of improvising splints.

If a compound fracture is present, the wound should be covered with a sterile dressing. No attempt should be made to reduce the fracture, even though one of the bone fragments is protruding through the skin. Splints should be applied as in any other type fracture. A pressure dressing should be applied over the wound to control bleeding.

As a rule, victims with fractures should not be moved until the injured part has been supported by temporary splints. There are times, however, when moving is necessary. In those cases the limb should be supported both above and below the site of the fracture, and traction should be applied in the direction of the long axis of the bone in order to prevent rotation as well as angular motion.

Victims with fractures can best be transported on a backboard. See Chapter XIII for detailed information on the use of the backboard.

THE FRACTURE LESION

DEFINITION

A lesion is any change in tissue formation. Fracture lesions may vary from a simple crack in the bone with mild disturbance of surrounding tissues to severe lesions with marked displacements of the fragments and much damage to all of the neighboring tissues.

The actual conditions at the site of the fracture are of the greatest importance, since they will help establish the general principles of care to be used by the squadman. In examining the victim the squadman should observe (1) the character of fracture and nature of soft-part damage, and (2) the stage of changes present.

Ordinarily when a bone is broken, the covering of the bone is torn and the surrounding soft parts are damaged to some extent. Blood vessels and glands are ruptured and the tissues become swollen and engorged with blood, lymph, and waste products. This causes swelling, pain and circulatory disturbances, all of which are increased by handling of the extremity and movement of the bone fragments.

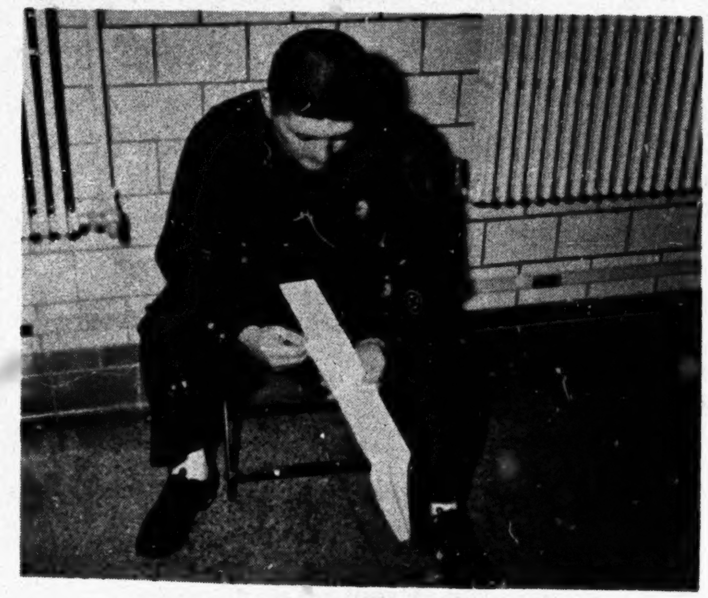
The blood, lymph, and waste rapidly begin to form a clot at the site of the injury. The bone ends at the fracture site and some of the soft tissues are killed by the injury, and in their disintegration they yield chemicals that break up the dead cells resulting in their being removed from the dead and dying bone. Later this calcium is used in the formation of a callus at the fracture site, a type of body-made splint.

The swelling and inflammation of the soft parts increases rapidly during the first eight to twelve hours. By the end of this time the muscles and other soft parts have lost their elasticity and have become waterlogged. Reduction by a physician at this late stage is more difficult to accomplish, and results in more damage to surrounding tissues. The fluid in the tissues occurs as the result of circulatory disturbance due to pressure from swelling.

At the scene of an emergency, the squadman should not only give emergency care to the obvious fracture lesion. He should be on the alert for symptoms of any other injury and must consider that a fracture may cause severe pain and hemorrhage with complicating shock.

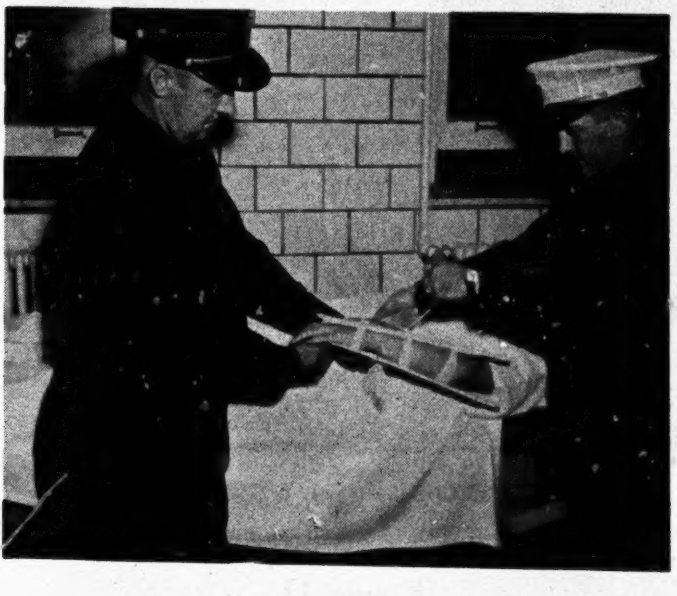
The fracture lesion description was presented here to show the seriousness of fractures. It has become an increasing problem in squad training to impress on the squadman the importance of good fracture care.

The old expression, "We are close to a hospital and do not need to splint," is absolutely senseless. A person who falls within a hospital is splinted first and then taken to the emergency room. Splint all suspected fractures.



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

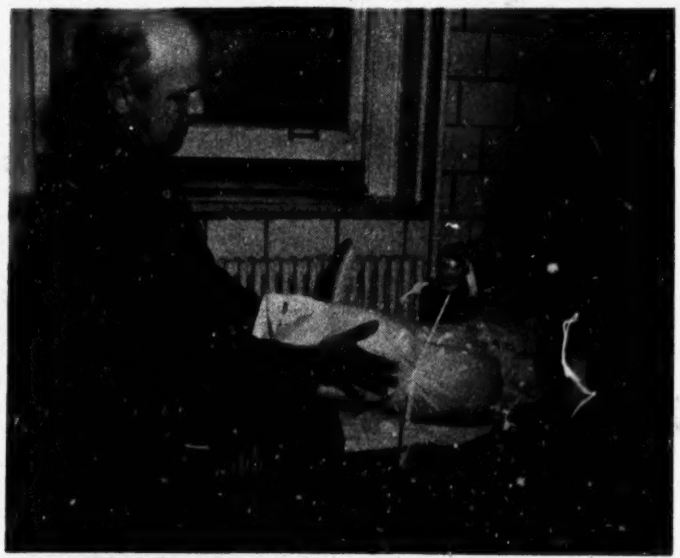
Figure 7



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

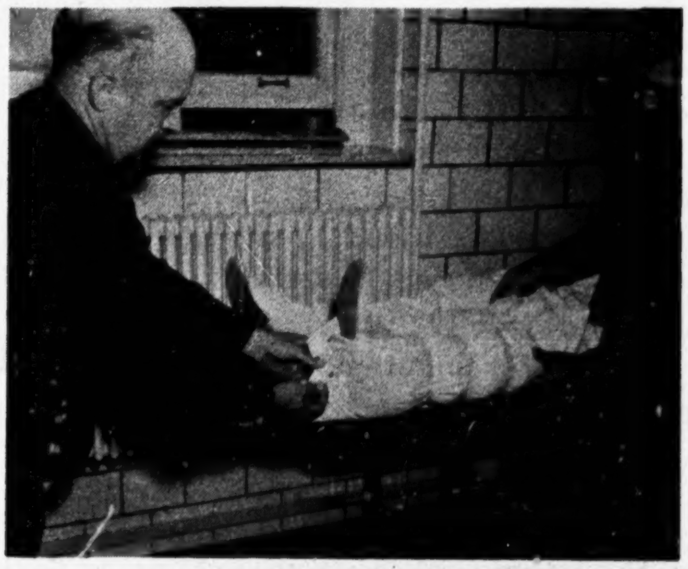
Figure 8

Board splints should be padded before they are put into service. See Figure 7. This small arm or leg splint will be more comfortable when applied, due to its being padded. After a padded splint board is in place, it is tied securely. See Figure 8. Splint boards should go beyond the adjacent joints: in this case, the elbow and wrist.



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

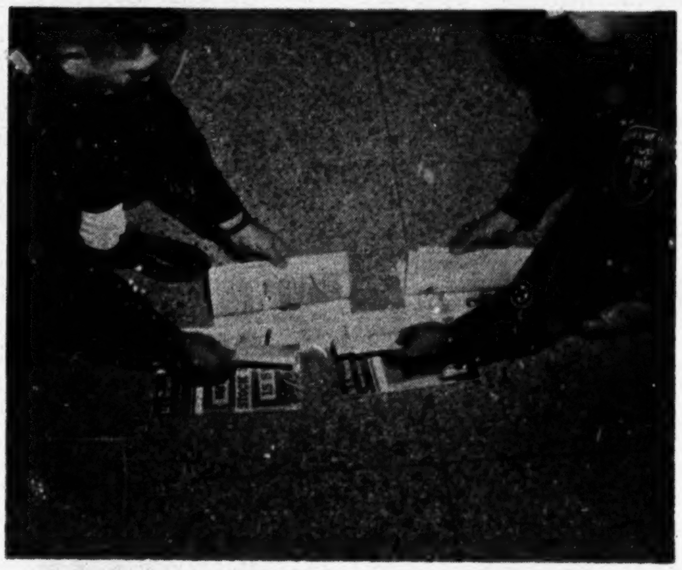
Figure 9



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

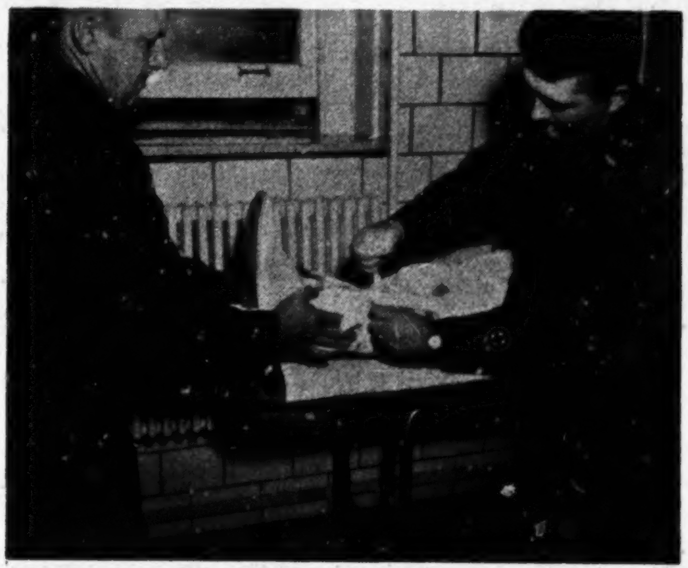
Figure 10

A splint can be improvised from household or squad pillows. Figure 9 shows one squadman supporting the victim's foot, while the other applies a two-inch roller bandage to secure the splint. After securing a pillow splint, the foot must be supported. Pinning the overlap of the pillow case, as shown in Figure 10, keeps the foot in an upright position and in the best alignment for transportation.



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

Figure 11



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

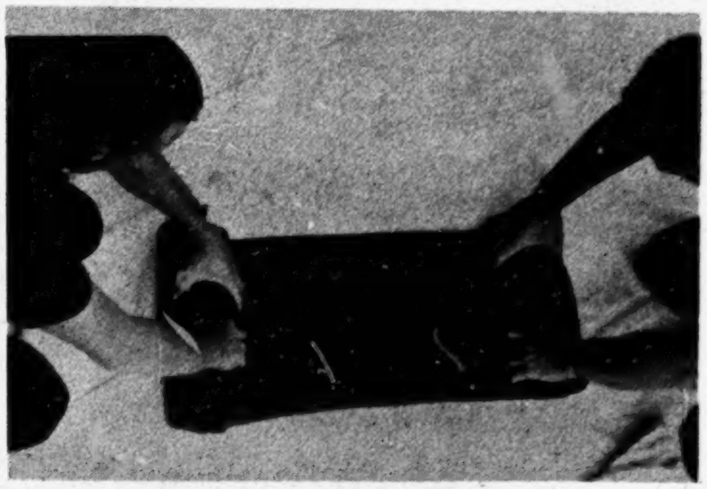
Figure 12

Improvised splints may be made from large magazines, interwoven as shown in Figure 11. An entire leg or arm could be immobilized this way and might require many magazines. Large magazines should be carried in all fracture kits. Figure 12 shows a magazine splint being applied. The knot is tied on one side, so as to make the splint as comfortable as possible for the victim. The splint runs above and below the joints adjacent to the fracture: in this case, the ankle and knee.

BLANKET ROLL SPLINT

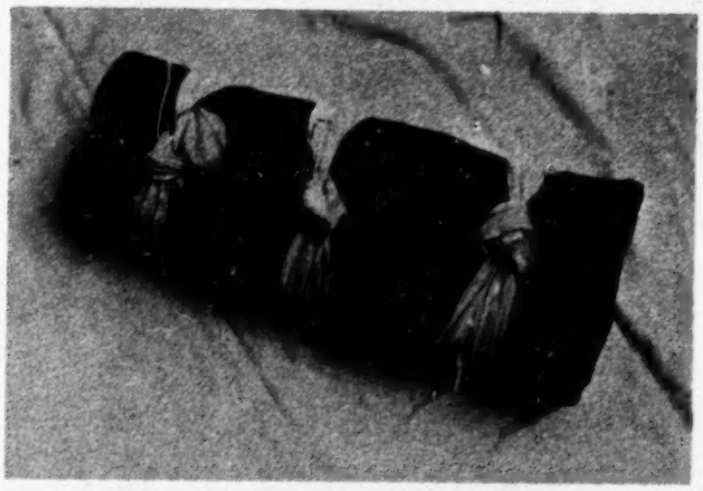
Many things can be used for improvising splints. A blanket roll is one of the most common. Figures 13 through 20 deal with making and applying blanket roll splints.

Two sizes should be carried on the squad truck: a short roll (12" to 16") for possible neck fractures, and a long roll (22" to 26") for arm and leg fractures.



Courtesy Sharon Twp. F.D., Worthington, O.

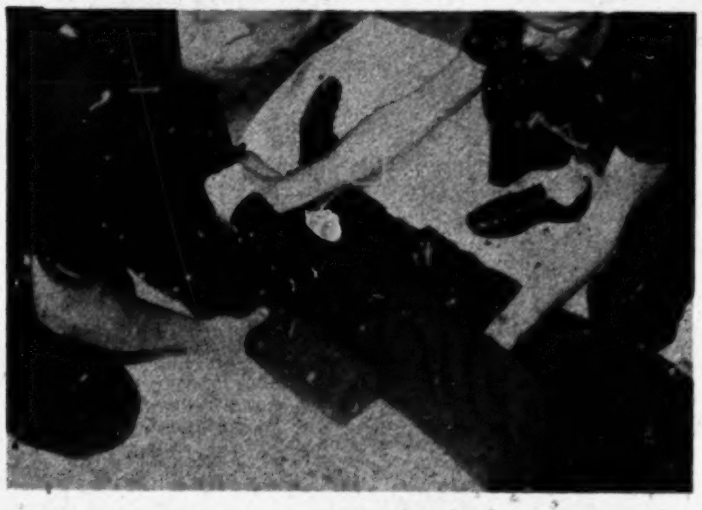
Figure 13



Courtesy Sharon Twp. F.D., Worthington, O.

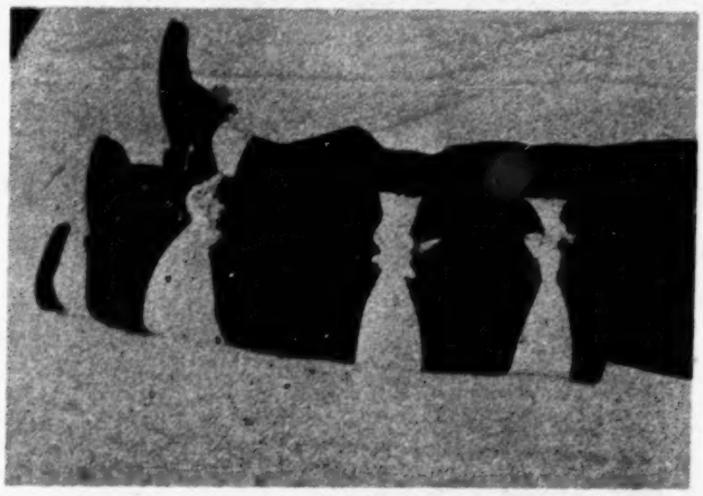
Figure 14

To make a blanket roll splint, fold a blanket until it is 12" to 16" wide. Roll it from both ends toward the center, tucking all wrinkles under (Figure 13.) Then tie it with 3 cravat bandages (Figure 14.) When the splint is needed, the cravats will be immediately available.



Courtesy Sharon Twp. F.D., Worthington, O.

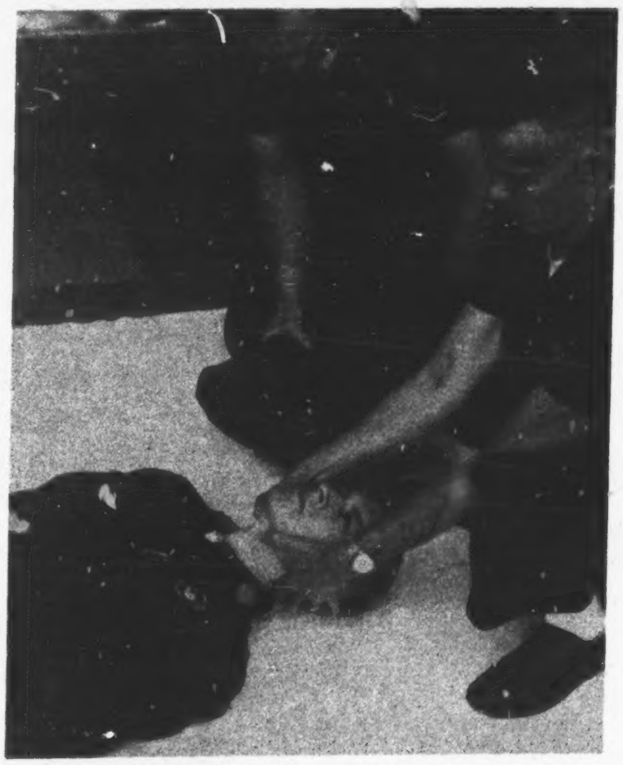
Figure 15



Courtesy Sharon Twp. F.D., Worthington, O.

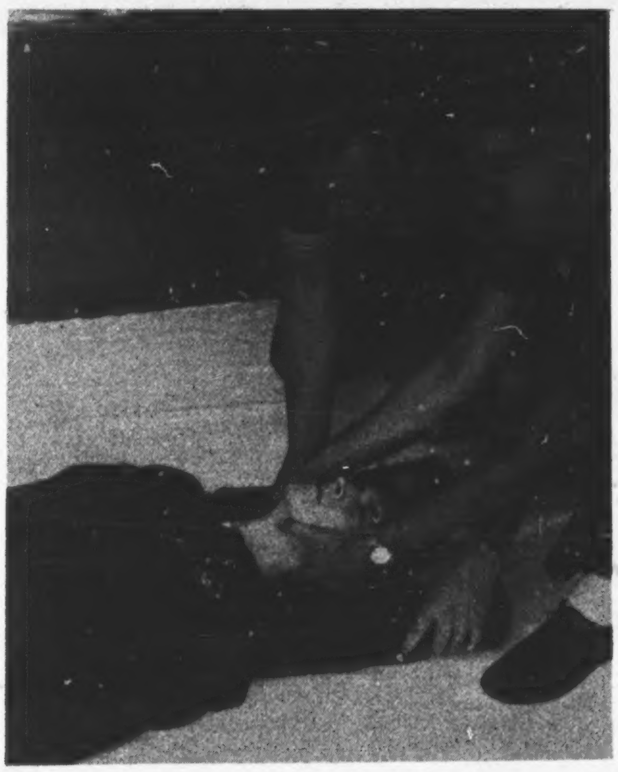
Figure 16

The long blanket roll splint can be applied to the extremities. Figure 15 shows the proper supporting of a suspected fracture and the application of the splint. Figure 16 shows the splint in place.



Courtesy Sharon Twp. F.D., Worthington, O.

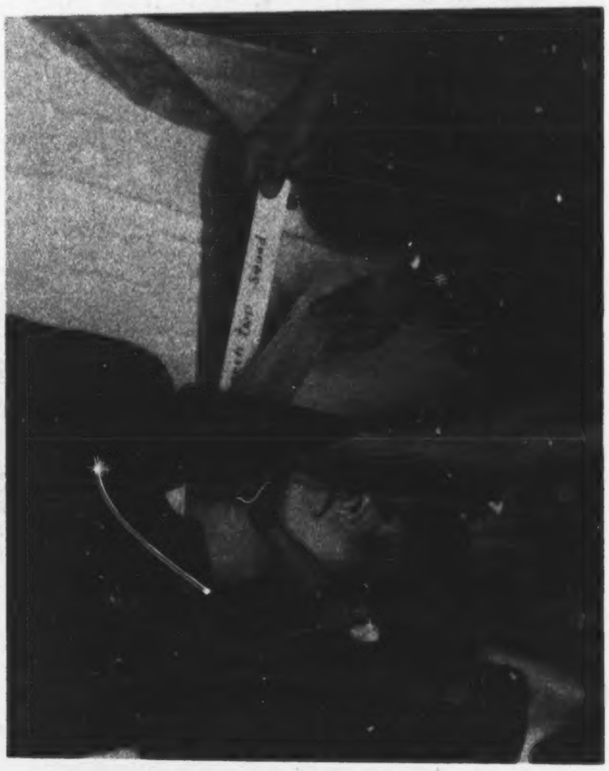
Figure 17



Courtesy Sharon Twp. F.D., Worthington, O.

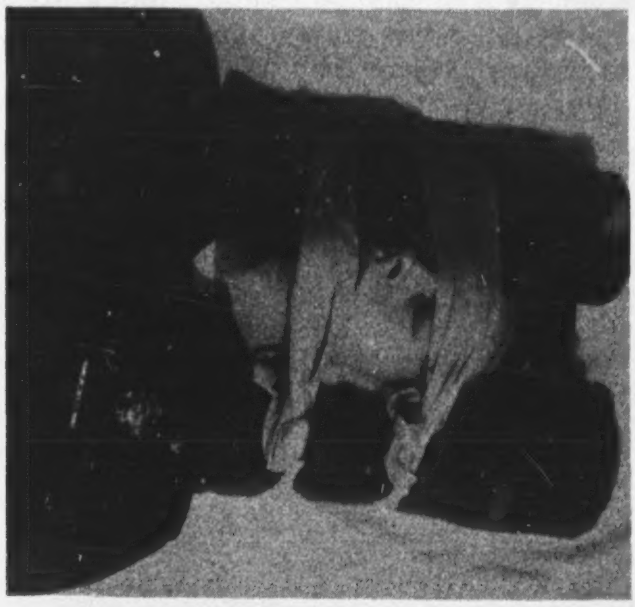
Figure 18

Figure 17 shows the proper way to hold a head when a fracture of the neck is suspected. One squadman is preparing the short blanket roll splint. Figure 18 shows how to place the blanket roll splint gently under the victim's head. The rolls on each side of the head must be placed firmly on the victim's shoulder and next to his head.



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 19



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 20

The cravats are pushed under the blanket with a flat, thin blade (Figure 19.) They can be brought down the splint from the top. Figure 20 shows the splint in place. It is positioned tightly against the victim's shoulders and head, to immobilize his head and neck.

CONVULSIONS IN CHILDREN

DEFINITION

A convulsion is a loss of consciousness with a generalized twitching of the muscles.

CAUSES

General convulsions in children have various causes.

In very young infants (two to four months) convulsions may be due to birth injuries. In older infants and young children a convulsion may mark the onset of an infectious disease, epilepsy, drug poisoning, or a nutritional disease. The cause may be unknown.

In children that the squadman will see, the usual cause of a convulsion is a high fever. (This is true 95% of the time.) This can be determined by just the touch of your hand on the child's skin.

SQUADMEN'S CARE

If a high fever is the cause of the convulsion, the cause must be eliminated. The child's temperature must be lowered.

This can be accomplished by sponging the child's body with cold applications. The solution used should be tap water, not ice water.

The proper way to "sponge" or cool a child's body is:

1. Obtain two large bath towels.
2. Fill a basin with cold tap water.
3. Take off all of the child's clothing.
4. Submerge towel in cold water and apply completely open, on one side of the child's body. (Front or back of the child).
5. Pat the towel; do not rub it. When the towel becomes warm, remove it and place a cold one under the child.
6. Repeat this procedure during transportation to a hospital or until a physician arrives.
7. An airway should be inserted to keep the victim's tongue forward. which will maintain a good exchange of air.

Remember to cool only one side of the body at a time. An ice bag can be placed on the child's head if desired. Also some physicians recommend the addition of an ounce of 70% alcohol (rubbing alcohol) to the water. Add this only on a physician's order.

The squadman should start this entire procedure as soon as possible and continue it until the convulsion stops or a physician arrives. He will probably recommend that this work be continued.

These children should be in the hands of medical personnel before the squadmen leave them.

CONTAGIOUS DISEASES

NEED FOR SPECIAL CARE

Sometimes, after an emergency squad has answered a call, has had direct contact with the victim, and has transported him to the hospital, it is found that the patient suffers from a contagious disease. Since there are many ways in which contagious diseases are transmitted, it is a must for all squadmen to take certain special care not only of their person and personal clothing, but of their equipment, apparatus, and vehicle.

PRECAUTIONS

The special precautions that must be taken, to prevent the spread of common communicable diseases, are listed in Table 1.

Some of the statements in the chart should be defined. When the squad truck is to be "aired for 12 hours" it should be out of service for that time. All windows and doors of the vehicle should be opened.

To "boil linens" means that the water should boil before adding the linens and the water should boil for at least 20 minutes after adding them. Be sure to tell the laundry that the linens you are having washed have already been boiled.

To "scrub car" means to wash the inside of the squad vehicle and any equipment with which the patient came in contact. Soap and warm water should be used. After washing, wipe down the vehicle with aqueous Zephiran solution 1:750. This solution can be bought at any drug store. Just moisten a cloth with this solution and go over all the parts that were washed.

LOCAL AUTHORITY

If there is any question at all about the contagious disease patient, you should call your county or city health physician. He is your local authority on contagious diseases.

All squadmen should wash their hands at the hospital after each run.

Table I HANDLING OF CONTAGIOUS DISEASES

COMMON NAME	MEDICAL SYNONYMS	INCUBATION PERIOD	MODE OF TRANSMISSION	CARE OF SQUAD VEHICLE AND LINENS *	CARE OF PERSONNEL **
Diphtheria	Membranous croup	1 to 7 days	Droplet infection and direct contact with cases or with a healthy carrier.	Air car 12 hours. Launder linens.	Schick test. Immunize.
Scarlet fever	Scarlatina	1 to 7 days	Droplet infection, foamites, carriers, pets occasionally.	Air car 12 hours, and scrub. Boil linens.	Dick test. Shower. Change and boil clothes.
Measles	Rubeola or Red measles	7 to 18 days; usually 9 to 11 days	Secretions from respiratory tract and eyes, droplet infection.	Air car 12 hours. Launder linens.	Wash hands.
German measles	Rubella	5 to 21 days	Direct contact, droplet infection from nose and mouth.	Air car 12 hours. Launder linens.	Wash hands.
Whooping cough	Pertussis	2 weeks	Droplet infection, carriers.	Air car 12 hours and scrub. Isolate and boil linens.	Shower. Change and boil clothes.
Mumps	Parotitis epidemic	12 to 24 days; usually 16 to 18 days	Direct contact, droplet infection from nose and mouth.	Air car 12 hours. Air and change linens.	Wash hands.
Chicken pox	Varicella	10 to 20 days; usually 14 days	Droplet infection from nose and mouth; direct or indirect contact.	Air car 12 hours and scrub. Boil linens.	Shower. Change clothes.
Smallpox	Variola	3 to 18 days; usually 10 to 12 days	Direct or indirect contact.	Scrub car. Burn linens.	Burn clothes. Re-vaccinate all exposed persons immediately.
Spinal meningitis or Cerebro-spinal fever	Meningococcus meningitis	3 to 7 days	Droplet infection from nose and mouth of patients or carriers.	Air car 12 hours. Launder clothes.	Shower. See M.D. for possible medication.
Typhoid fever	Enteric fever	10 to 15 days	Fecal contamination of food, water, or milk.	Air car 12 hours. Boil linens if contaminated with urine or feces.	Wash hands and face.
Tuberculosis	Koch's disease or TB	Varies	Infected sputum.	Use sputum cups and burn. Scrub car. Boil clothes and linens.	Avoid close facial contacts.
Syphilis	Lues VD	3 weeks	Usually sexual contact.	Air and launder linens. (No special car care.)	Wash hands. If scratched call M.D.
Infantile paralysis	Poliomyelitis	7 to 14 days	Uncertain: possibly nose and throat.	Air car 12 hours. Launder linens. Wash equipment with soap and warm water.	Shower. Change clothes.
Hepatitis	Serum hepatitis or Infectious hepatitis	10 to 14 days	Infected blood.	Air car 12 hours. Boil linens if contaminated with blood or feces.	Wash hands.

* When a car is being "aired," it is not to be in service. To "scrub car" means to wash the entire inside of the squad car with soap and water.

** In all of these conditions, except syphilis, the squadmen should use cloth, contagious-disease masks.

POISONS

DEFINITIONS

Demulcent: An agent that will soothe a part. (Olive oil, glycerin, milk)

Emesis: Act of vomiting

Emetics: Materials that produce vomiting

Extremities: Usually refers to the arms and legs

Gastric: Pertaining to the stomach

Lavage: To wash out a cavity (stomach)

Stomach tube: Refers to a stomach pump. Squadmen never use these.

SQUADMEN'S CARE

The United States Pharmacopeia (U.S.P.) encourages all manufacturers of poisonous material to print the antidote on the container. Look for such information first and carry out instructions if possible.

Figure 21 lists telephone numbers for centers in Ohio that provide emergency information about poisons. Figure 22 describes counterdoses for many poisons.

If a victim is unconscious, do not try to give fluids. If he is even a little dizzy or resistive, be cautious in trying to dilute the stomach contents.

If you are to dilute the substance in the stomach and cannot obtain the antidote, use water. Dilution, or washing out of the stomach, can be carried out enroute to the hospital. Have the radio dispatcher notify the hospital that you are coming.

Squads should carry a carbon dioxide-oxygen mixture, but the mixture should be used only on a physician's prescription. He can prescribe in person, in writing, or by phone.

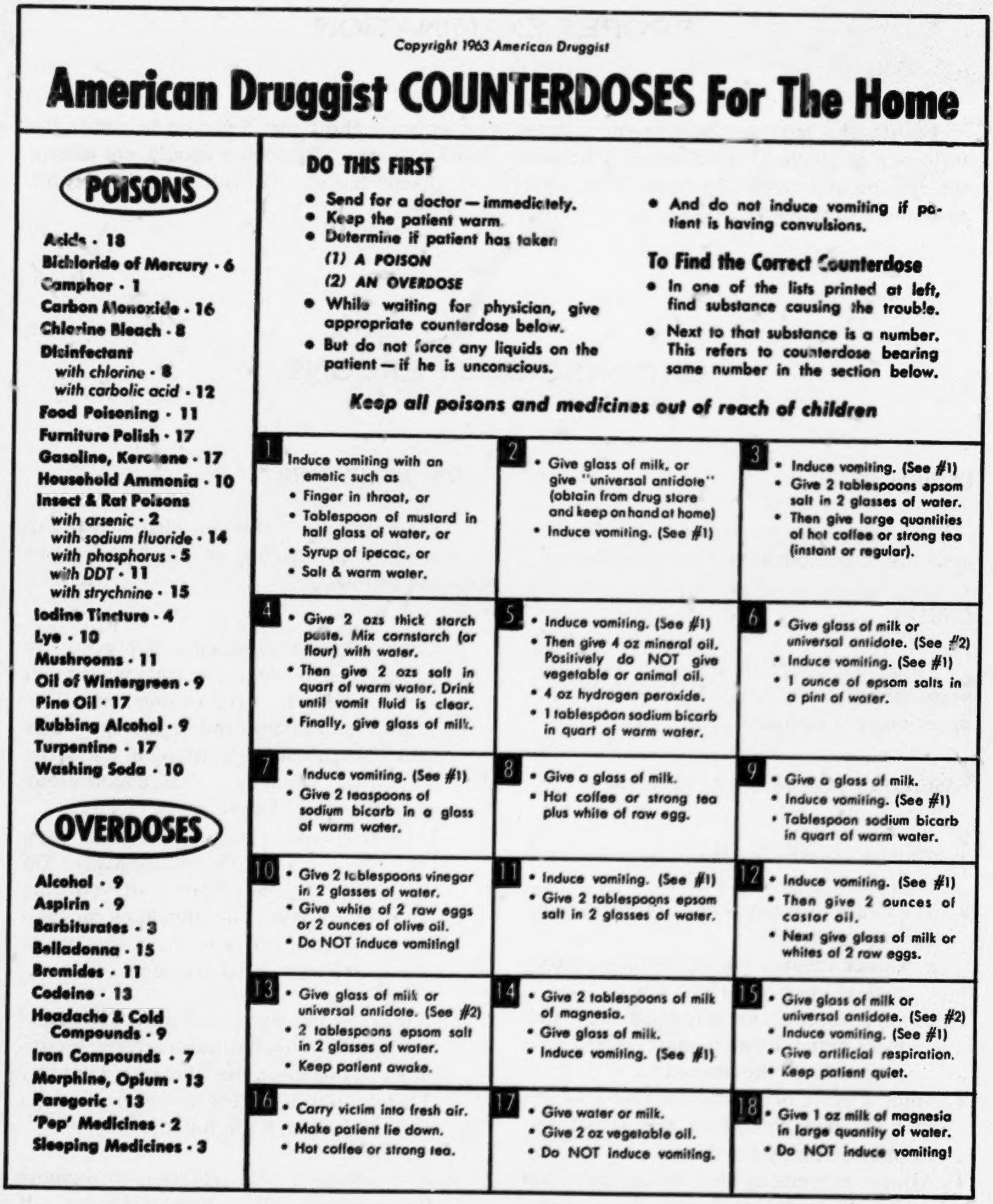
These centers have agreed to cooperate in a program to extend their services to any physician requesting information from them. When a center is called the physician should have four basic facts in mind (1) The full name or brand of the product ingested or inhaled; (2) An accurate estimation of the amount of the particular agent ingested; (3) The time of ingestion; (4) The age and weight of the patient.

LOCATION	FACILITY	TELEPHONE
AKRON	Children's Hospital W. Bowery and W. Bechtel	BL 3-5531, EXT. 246
CINCINNATI	The Academy of Medicine of Cincinnati 320 Broadway	PA 1-2345
CLEVELAND	Cleveland Academy of Medicine 10525 Carnegie Ave.	CE 1-4455
COLUMBUS	Children's Hospital 561 S. 17th St.	CL 8-9783
DAYTON	Poison Information Office United States Air Force Hospital Wright-Patterson-Air Force Base, Ohio	253-7111, EXT. 78335
MANSFIELD	Mansfield General Hospital 335 Glessner Ave.	LA 2-3411, EXT. 248
SPRINGFIELD	City Hospital E. High and Burnett Rd.	FA 3-5531, Ext. 226
TOLEDO	Toledo Health Department 635 N. Erie St.	CH 4-1961—(Day) EV 5-4661—(NIGHT)
YOUNGSTOWN	Emergency Room Dept. St. Elizabeth Hospital 1044 Belmont Street	RI 6-7231, EXT. 220

Courtesy American Druggist

Figure 21

Poison information centers in Ohio.



Copyright 1963 American Druggist

American Druggist COUNTERDOSES For The Home

POISONS

- Acids · 18
- Bichloride of Mercury · 6
- Camphor · 1
- Carbon Monoxide · 16
- Chlorine Bleach · 8
- Disinfectant
  - *with chlorine* · 8
  - *with carbolic acid* · 12
- Food Poisoning · 11
- Furniture Polish · 17
- Gasoline, Kerosene · 17
- Household Ammonia · 10
- Insect & Rat Poisons
  - *with arsenic* · 2
  - *with sodium fluoride* · 14
  - *with phosphorus* · 5
  - *with DDT* · 11
  - *with strychnine* · 15
- Iodine Tincture · 4
- Lye · 10
- Mushrooms · 11
- Oil of Wintergreen · 9
- Pine Oil · 17
- Rubbing Alcohol · 9
- Turpentine · 17
- Washing Soda · 10

OVERDOSES

- Alcohol · 9
- Aspirin · 9
- Barbiturates · 3
- Belladonna · 15
- Bromides · 11
- Codeine · 13
- Headache & Cold Compounds · 9
- Iron Compounds · 7
- Morphine, Opium · 13
- Paregoric · 13
- 'Pep' Medicines · 2
- Sleeping Medicines · 3

DO THIS FIRST

- Send for a doctor — immediately.
- Keep the patient warm.
- Determine if patient has taken
  - *(1) A POISON*
  - *(2) AN OVERDOSE*
- While waiting for physician, give appropriate counterdose below.
- But do not force any liquids on the patient — if he is unconscious.
- And do not induce vomiting if patient is having convulsions.

To Find the Correct Counterdose

- In one of the lists printed at left, find substance causing the trouble.
- Next to that substance is a number. This refers to counterdose bearing same number in the section below.

Keep all poisons and medicines out of reach of children

1
Induce vomiting with an emetic such as
- Finger in throat, or
- Tablespoon of mustard in half glass of water, or
- Syrup of ipecac, or
- Salt & warm water.

2
- Give glass of milk, or give "universal antidote" (obtain from drug store and keep on hand at home)
- Induce vomiting. (See #1)

3
- Induce vomiting. (See #1)
- Give 2 tablespoons epsom salt in 2 glasses of water.
- Then give large quantities of hot coffee or strong tea (instant or regular).

4
- Give 2 ozs thick starch paste. Mix cornstarch (or flour) with water.
- Then give 2 ozs salt in quart of warm water. Drink until vomit fluid is clear.
- Finally, give glass of milk.

5
- Induce vomiting. (See #1)
- Then give 4 oz mineral oil. Positively do NOT give vegetable or animal oil.
- 4 oz hydrogen peroxide.
- 1 tablespoon sodium bicarb in quart of warm water.

6
- Give glass of milk or universal antidote. (See #2)
- Induce vomiting. (See #1)
- 1 ounce of epsom salts in a pint of water.

7
- Induce vomiting. (See #1)
- Give 2 teaspoons of sodium bicarb in a glass of warm water.

8
- Give a glass of milk.
- Hot coffee or strong tea plus white of raw egg.

9
- Give a glass of milk.
- Induce vomiting. (See #1)
- Tablespoon sodium bicarb in quart of warm water.

10
- Give 2 tablespoons vinegar in 2 glasses of water.
- Give white of 2 raw eggs or 2 ounces of olive oil.
- Do NOT induce vomiting!

11
- Induce vomiting. (See #1)
- Give 2 tablespoons epsom salt in 2 glasses of water.

12
- Induce vomiting. (See #1)
- Then give 2 ounces of castor oil.
- Next give glass of milk or whites of 2 raw eggs.

13
- Give glass of milk or universal antidote. (See #2)
- 2 tablespoons epsom salt in 2 glasses of water.
- Keep patient awake.

14
- Give 2 tablespoons of milk of magnesia.
- Give glass of milk.
- Induce vomiting. (See #1)

15
- Give glass of milk or universal antidote. (See #2)
- Induce vomiting. (See #1)
- Give artificial respiration.
- Keep patient quiet.

16
- Carry victim into fresh air.
- Make patient lie down.
- Hot coffee or strong tea.

17
- Give water or milk.
- Give 2 oz vegetable oil.
- Do NOT induce vomiting.

18
- Give 1 oz milk of magnesia in large quantity of water.
- Do NOT induce vomiting!

Courtesy American Druggist

Figure 22
Counterdoses for common poisons and overdoses.

PROPER EXAMINATION

People who have not been trained sometimes wrongly think that a victim is under the influence of alcohol, when actually he needs medical care. Squadmen should not accept the opinion of a casual bystander that a victim is "drunk" but should examine carefully for symptoms of diabetes, epilepsy, and other conditions.

UNCONSCIOUS PERSONS

DEFINITION

Unconsciousness is the state of being insensible or without conscious experiences.

CAUSES

To describe here all the causes of unconsciousness in not feasible; they are too many and too complex.

ESSENTIAL POINTS TO REMEMBER

1. The air passage is usually poor at some time during the illness.
2. The inhaling of any foreign material may cause death.
   a. Check closely for any foreign material in the patient's mouth.
   b. Check closely for any vomiting which may bring foreign material to the mouth from the stomach.
3. Since a state of unconsciousness means that all body functions are impaired, respiration may be slower.
4. Always remember that the unconscious person is breathing, while the asphyxiated person is unconscious and not breathing.

SQUADMEN'S CARE

Check the victim for any difficulty in air exchange. If difficulty is noted, you must do the following:

1. Check his air passage. If a good air passage is needed, the squadman must insert a plastic, hard rubber, metal or improvised airway immediately. This will keep the paralyzed tongue out of the way of the windpipe. The unconscious person can still have a gag reflex.
   If there should be any sign of gagging on the airway, remove it immediately. Do not cause the complication of vomiting with the airway. The squadman can then lift up on both sides of the angle of the jaw to create a good air passage.

2. If there is any sign of vomiting or coughing up of any foreign material, the victim must be turned on his side immediately. This will facilitate the flow of any foreign materials out of the mouth.

3. It is always a safe practice to support these people with a flow of oxygen. If they should stop breathing, resuscitate them.

DIABETES

DEFINITION

Diabetes is a chronic disorder of the metabolism, the basis of which is an inability of the cells to use sugar. This defect probably is due to a deficiency of insulin production by the cells of the pancreas. The diabetic can go into either of two conditions: diabetic coma or insulin shock.

(A) DIABETIC COMA

This condition is caused by the incomplete oxidation of fatty acids, which produces acetone bodies and is common in uncontrolled diabetes.

Clothing of any person in a coma should be checked for a card which states that he is a diabetic. Relatives or friends may volunteer the information.

SIGNS OR SYMPTOMS

1. The victim can be confused and unable to cooperate.
2. Nausea and vomiting may be present.
3. The breathing is characterized by very deep, yet not labored respiratory movements. There is no evidence of obstruction of the air passages or any blueness.
4. The skin is dry and cold.
5. The breath has a sweetish or fruity odor which is acetone.

SQUADMEN'S CARE

Since this victim needs insulin and the squadmen are not permitted to administer it, transport him to a hospital immediately. He requires careful, expert, and immediate attention from a physician.

(B) INSULIN SHOCK

Insulin shock is likely to occur in a diabetic when, for any reason, the blood sugar falls. It results usually from the omission of a meal or the vomiting of a meal after taking insulin. Some attacks follow undue exertion. The majority of attacks occur in the morning and in the early evening. An individual whose store of blood sugar is depleted as a result of emotional excitement, exertion or exposure to cold has an increased sugar tolerance and reacts to insulin with a comparatively greater blood-sugar drop than would otherwise be the case. He is, therefore, a candidate for insulin shock; that is, he is temporarily insulin-sensitive.

These reactions begin in five to twenty minutes following an injection of regular insulin, but not for several hours after other types are given. The symptoms and signs should be familiar to every squadman.

SIGNS OR SYMPTOMS

1. General muscular weakness, together with mental confusion
2. Restlessness
3. Profuse sweating
4. Dizziness
5. Pallor or flushing of the face
6. Trembling
7. Hunger pangs in the upper stomach

The victim may lapse into a coma. Some victims' blood sugar lowers so rapidly that the symptoms progress almost without warning to those of epileptiform convulsions.

SQUADMEN'S CARE

When the warning symptoms appear, the victim should take a drink containing sugar or consume a piece of candy at once. All persons taking insulin should carry sugar in some form in their pockets. Such sugar checks the reaction within a few minutes. If the sudden attack progresses to convulsions, care for the victim as you would any convulsing person.

If untreated, a reaction may result in death, but this seldom occurs. These people should be transported as soon as possible to the closest emergency room.

CRITICAL QUESTIONS

Two questions that can be asked of the diabetic to determine which state he might be entering are as follows:

1. Have you eaten today?
2. Have you taken your insulin today?

If the person has taken his insulin and has not eaten, he is going into insulin shock. If he has eaten and has not taken his insulin he is entering diabetic coma. These two questions should be memorized and be ready for use at any time by the squadman.

EPILEPSY

DEFINITION

Epilepsy is a disease characterized by attacks of loss of consciousness, with or without convulsions. Some of the most pronounced epileptics have few convulsions - possibly none at all - while violent convulsions, in every way similar to those of epilepsy, may be due to other conditions. The mildest cases of true epilepsy also may have no true convulsions, but merely attacks of momentary unconsciousness, although these have the same significance as the most violent seizures.

The epileptic attack should be called a seizure - never a "fit."

SQUADMEN'S CARE

Cool presence of mind and prompt action are important in caring for any type of convulsion. One of the first steps indicated is to insert some object between the victim's teeth to prevent him from biting his tongue. This cannot be done during a seizure, but should be carried out when it appears that the victim will be entering a seizure momentarily. If the victim is experiencing a series of seizures, the mouth gag can be inserted during the relaxed state between seizures.

An effective mouth gag can be fashioned quickly by binding together several tongue depressors with adhesive tape, wrapping one end with gauze. (See Figures 23 and 24.) This gag should be placed between upper and lower teeth at the back of the mouth. Never put your fingers in an epileptic's mouth.

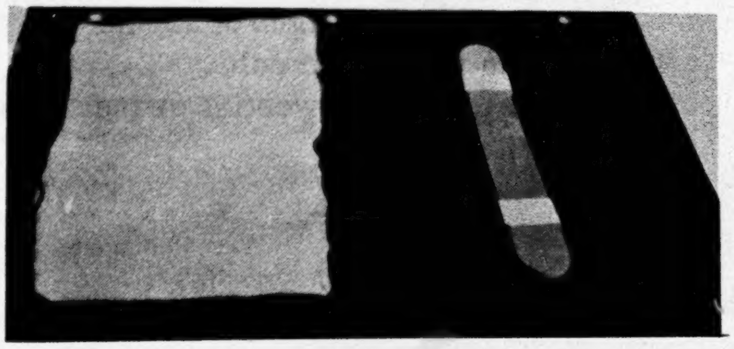


Figure 23

To make a padded tongue blade, tape two large tongue blades together with ½-inch tape. Also needed is a 4x4 compress.

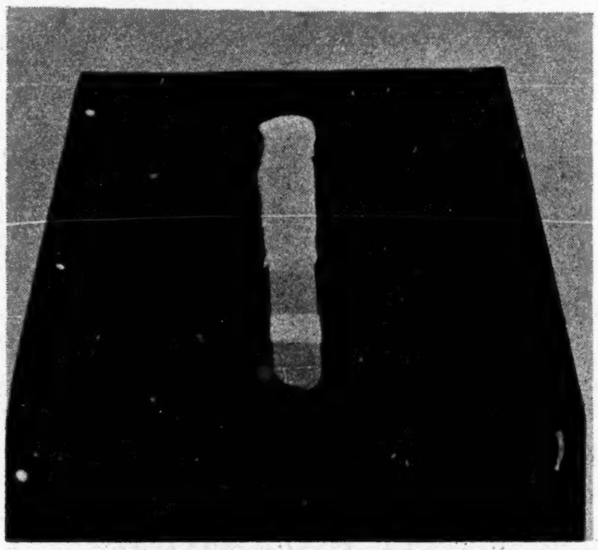


Figure 24

The compress is wrapped completely around one end of the tongue blades and made secure with two pieces of ½-inch tape.

The victim should be stretched out full-length on the floor or a bed. The clothing around his neck and chest should be removed or loosened. His movements should be guided to prevent him from injuring himself.

Victims sometimes become quite blue and may not breathe for long periods. This is not usually a problem, as they will start to breathe as soon as the relaxation period starts after the initial attack.

The head of the epileptic should be protected at all times. This can be accomplished by placing some soft material under his head. It is not at all uncommon for an epileptic to receive a fractured skull during his seizure due to striking his head on hard objects.

Never apply restraint. The duration of the convulsion and the general reaction following it should be observed and included in the notes for the doctor. Most epileptic victims following a seizure will go into a deep sleep. Close observation should be kept for the few who will have maniacal or homicidal tendencies.

The squadmen should make a victim comfortable and move him as needed. He should then be taken to medical attention.

STROKE

DEFINITIONS

A stroke is loss of consciousness and paralysis due to hemorrhage into the brain or spinal cord which forms a clot cutting off the blood supply. It is often called apoplexy or a stroke of paralysis.

Cerebral hemorrhage (escape of blood into the tissues of the brain) generally occurs in elderly victims who have had high blood pressure for some time.

Arteriosclerosis (hardening of the arteries) with a low blood pressure often leads to a cerebral thrombosis (a blood clot obstructing a blood vessel) in which the onset is gradual. There may be a feeling of numbness in one extremity, mental confusion, and inability to concentrate. Later the victim may lapse into unconsciousness with or without paralysis.

SQUADMEN'S CARE

1. Elevate the victim's head slightly.
2. Place cold cloths or ice bag on victim's head.
3. Do not move the victim any more than is necessary.
4. Do not attempt to give the victim anything by mouth and do not give stimulants.
5. Give oxygen by mask as an inhalator; if the victim should stop breathing, the use of the resuscitator should immediately be initiated.
6. Constant watch by the squadmen must be maintained at the side of any breathing, unconscious victim. You must especially facilitate a good air-way in a stroke victim, as they are prone to accidental asphyxiation.
7. Transport as soon as possible. If the hemorrhage is massive the victim may die within a short time.

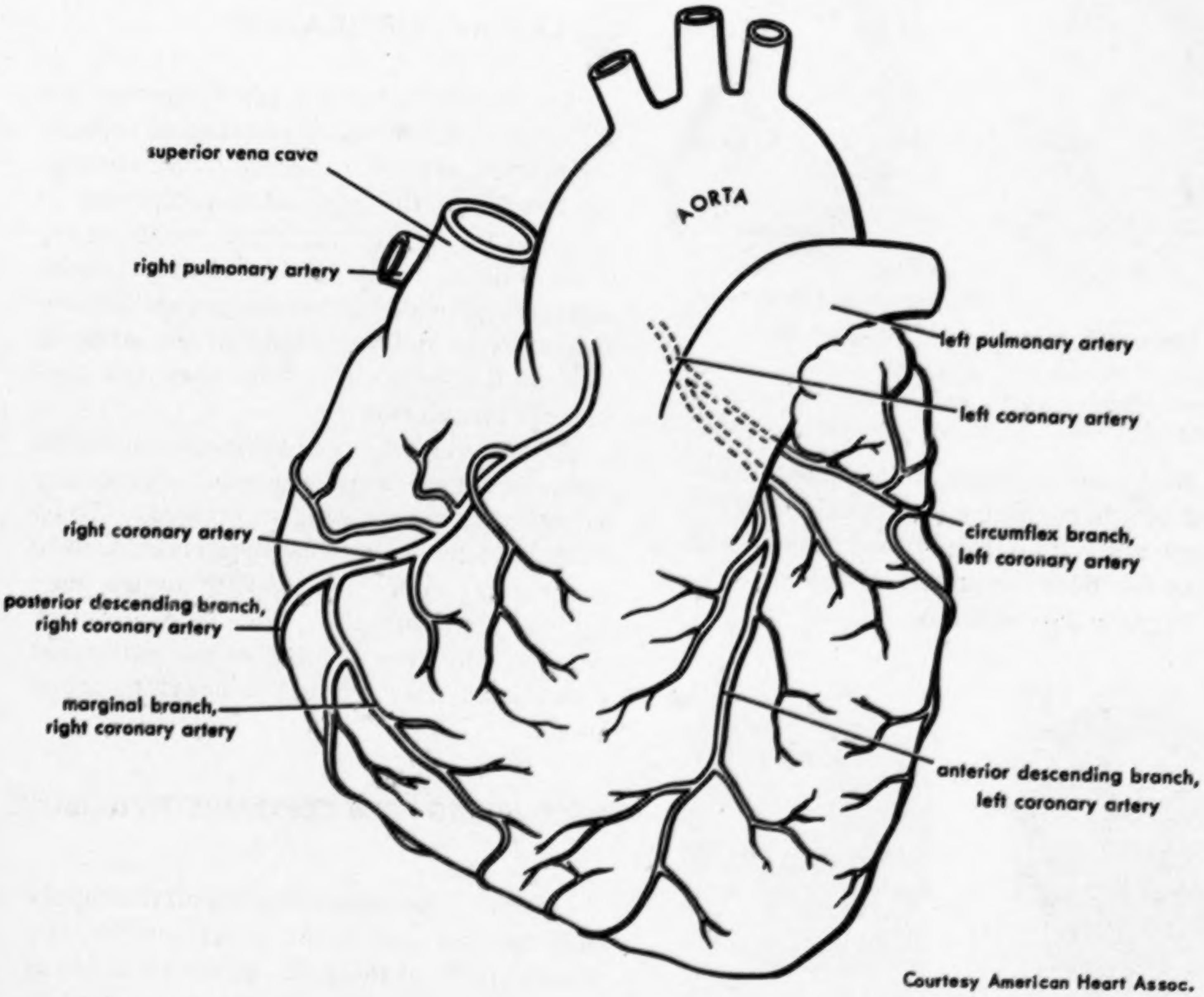
GENERAL INFORMATION ABOUT HEART ATTACK

CORONARY THROMBOSIS

Usually a "heart attack" means an acute condition that doctors call coronary thrombosis. It is a sudden blocking of one of the coronary arteries: the arteries that supply the heart muscle with blood.

(See Figure 25.)

Although a heart attack itself is sudden, it is the result of atherosclerosis: a slowly developing disease process of the coronary arteries. Atherosclerosis causes most heart attacks and the chest pain called angina pectoris. It is a form of arteriosclerosis (hardening of the arteries).

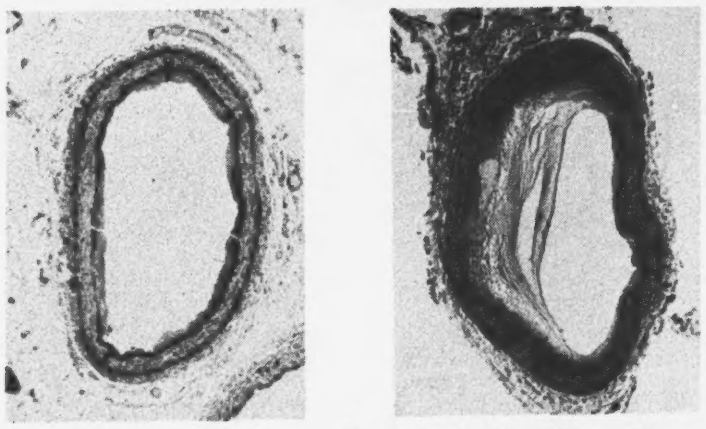

superior vena cava
right pulmonary artery
AORTA
left pulmonary artery
left coronary artery
circumflex branch, left coronary artery
right coronary artery
posterior descending branch, right coronary artery
marginal branch, right coronary artery
anterior descending branch, left coronary artery

Courtesy American Heart Assoc.

Figure 25

The main coronary arteries with their many branches come down over the top of the heart like a crown (corona) and send tinier branches or twigs down into all parts of the heart muscle to supply it with oxygen-carrying blood.

In atherosclerosis, the passageway through the arteries becomes roughened and narrowed by fatty deposits that harden into patches along the inner lining of the artery. This process has been compared to the formation of lime deposits in a water pipe. Around the patches scar-like fibrous tissue forms in the artery wall so that the channel is narrowed and there is less room for blood to flow through.
(See Figures 26A and B.)

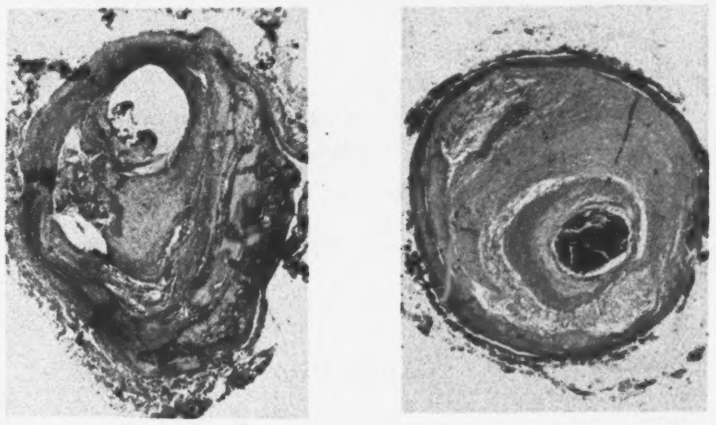


Courtesy American Heart Assoc.

Figure 26A **Figure 26B**

Figure 26A shows a cross-section of a normal artery greatly enlarged. Figure 26B shows deposits found in the inner lining.

A blood clot can form in an artery narrowed by atherosclerosis. This blocks the channel and cuts off the blood flow to the part of the heart supplied by the artery. (See Figures 27A and B.)



Courtesy American Heart Assoc.

Figure 27A **Figure 27B**

Deposits harden, then a blood clot blocks the narrowed channel.

When a clot (thrombus) cuts off the blood supply to a section of heart muscle, the result is a heart attack. Physicians call it a coronary thrombosis, coronary occlusion, or myocardial infarction. The usual symptoms are:

1. Severe painful sensation of pressure under the breastbone, often lasting for hours. (Mild attacks are sometimes mistaken for acute indigestion.)
2. Sudden intense shortness of breath
3. Sweating
4. Loss of consciousness (occasionally)

COLLATERAL CIRCULATION

Luckily the coronary artery system has a life-saving method of growth and repair. When some of the coronary arteries become narrowed by the gradual development of atherosclerosis so that they cannot carry enough blood to the heart muscle, nearby arteries get wider and even open up tiny new branches to deliver blood to the area of muscle that needs it. This is called collateral circulation.

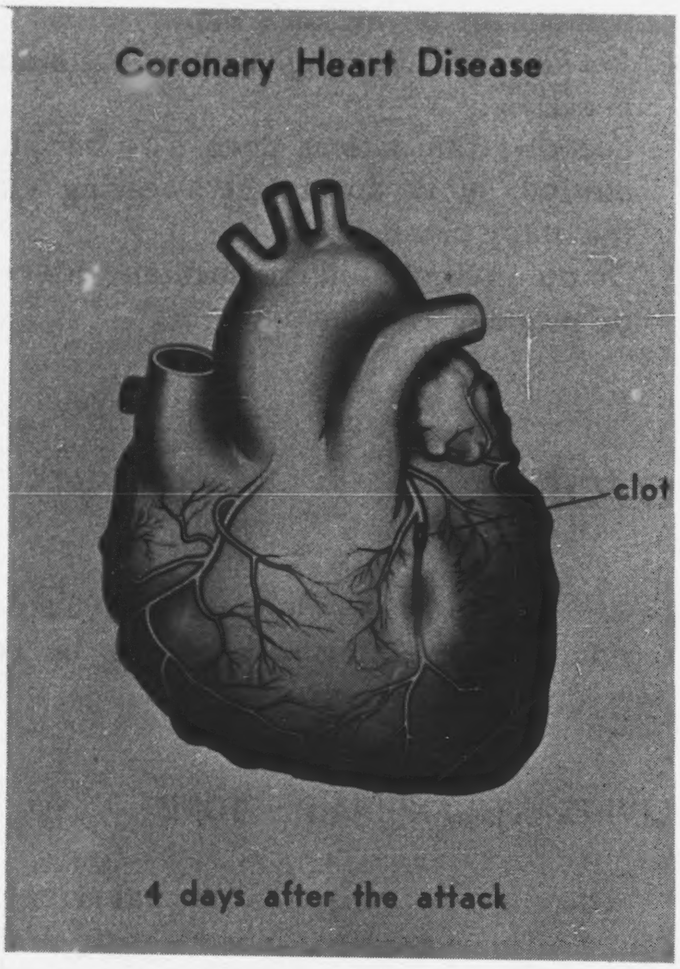
This collateral or substitute circulation often develops while the main coronary arteries are becoming narrowed. This explains why many of us who have narrowed arteries are not troubled with angina pectoris or heart attacks. Once a heart attack occurs, the development of the collateral circulation may help the heart to mend itself.

RECOVERING FROM CORONARY THROMBOSIS

When a clot suddenly shuts off the supply of blood to a part of the heart muscle, the central part of the area deprived of blood may die. The affected area must heal to form strong scar tissue. At the same time, a new blood supply to the area develops by means of the collateral circulation just described. (See Figures 28 and 29.)

Treatment is aimed at giving the heart time to mend itself. Even though the patient feels well after the first week, he must continue to rest in bed or chair to give the heart time to heal.

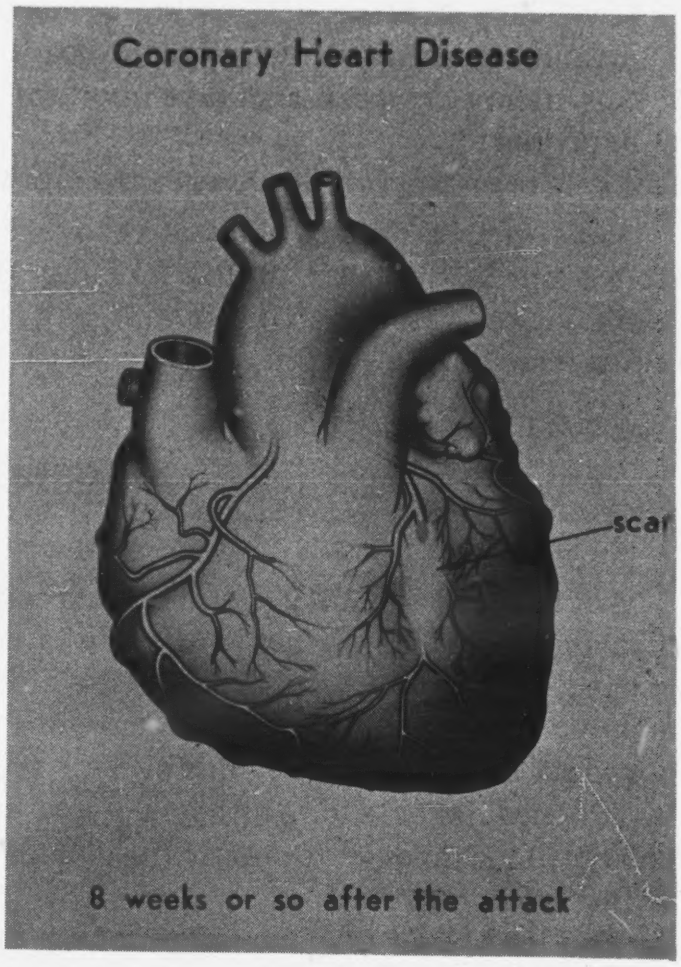
The time required for the patient to get back on his feet will depend on the extent of the heart injury, the rate of healing, and whether or not complications develop. Although medicines are helpful, the patient's cooperation and understanding play a large part in his recovery.



Courtesy American Heart Assoc.

Figure 28

White cells are clearing away the dead tissue. Scar tissue is beginning to form at the edges of the damaged area (just below the clot). The patient must remain quiet because during the first two weeks or so there is danger that this weak spot will rupture.



Courtesy American Heart Assoc.

Figure 29

Tough scar tissue has formed. The patient begins to resume activities. He must keep his weight down, avoid severe mental and physical strain. Moderate physical activity is encouraged.

MOST PATIENTS RETURN TO WORK

Most patients are able to continue with their usual job once they have recovered from a heart attack. Some may have to make job adjustments and changes in their manner of living. The patient who has had a heart attack is advised to:

1. Keep his weight down.
2. Eat frequent small meals rather than a few heavy meals. (Digesting a heavy meal makes heavy demands on the heart.)
3. Get plenty of rest and take moderate exercise.
4. Avoid overexertion and overexcitement.

Sometimes a patient who has recovered from a coronary heart attack has anginal pains. (See below.) This is a signal for him to consult his doctor.

HOW TO HELP IN CASE OF A HEART ATTACK

1. Call the doctor at once.
2. Help the patient take the position that is most comfortable for him. (This will probably be halfway between lying and sitting. He usually cannot breathe comfortably if he lies flat.)
3. Do not attempt to carry or lift a patient without the physician's supervision.
4. Loosen tight clothing such as belts and neckties.
5. See that the patient does not become chilled, but do not induce sweating with too many blankets.
6. Do not give stimulants such as whiskey or brandy.

ANGINA PECTORIS

Angina pectoris is a severe chest pain that signifies that the heart muscle is not getting enough oxygen through its blood supply. It usually means that some of the coronary arteries have become so narrowed by atherosclerosis that they do not let enough blood through to supply the demands of the heart muscle.

The individual may complain of severe chest pain with a sensation of oppression under the breastbone or strangling. The pain may be accompanied by numbness and often spreads to the left shoulder, arm, or hand. This is a typical anginal attack or episode. It is usually brought on by effort or excitement, or after a heavy meal. The pain does not last long. As a rule, it is relieved within a short time by rest or by nitroglycerine tablets.

Sometimes anginal pains occur in persons who have recovered from a heart attack. Sometimes they occur in people who never had a heart attack and who may never have one. However, chest pain may be due to other causes. It should always be reported to a physician.

LIVING WITH ANGINA PECTORIS

The same process of collateral circulation that increases the blood supply to the heart muscle after a heart attack can also come to the aid of the patient with angina pectoris. Given time, some branches of the coronary arteries may enlarge and new branches open to deliver enough blood to the heart muscle to enable the individual to carry on his usual activities.

That is why most persons can be comfortable and lead productive lives even though they must cope with angina pectoris. Each case is individual; only the patient's own doctor can determine the course he should follow and the medicine he should take.

Regulating habits of life is important in controlling anginal attacks. Physician and patient must work out a program together.

As a rule, patients who have had angina pectoris should avoid overexertion, rushing, worrying, intense cold, and overweight. They are advised to eat four small meals daily rather than three heavy meals, and should rest twenty minutes or so after eating.

Certain drugs are helpful, too. The physician almost always prescribes nitroglycerine tablets. The patient is told to let a tablet dissolve under the tongue to relieve the pain of angina. Often, if he expects to be in a difficult or exciting situation, the patient is told to take a tablet beforehand to avoid an attack of anginal pain.

TECHNICAL INSTRUCTIONS FOR SQUADMEN CONCERNING CORONARY ATTACK

THE TISSUES INVOLVED

The blood vessels of the body are made up of three layers: (1) an outer protective layer, (2) a muscular center layer and (3) a smooth inner layer. The center muscular layer is the one which is most highly involved in the coronary heart attack.

BLOOD SUPPLY SHUT OFF

A person who experiences fear or pain becomes very tense; all his muscles tend to tighten. The pain that a victim experiences due to the formation of a clot within the coronary artery, and associated fear, cause the muscular layer of the blood vessels around the clot to clamp down. If this muscular layer does not relax, blood will be unable to pass the affected area. The part of the heart that is involved will die.

It follows then that it is of the greatest importance to do everything possible to help a victim to relax.

SYMPTOMS

The following symptoms will be exhibited by a heart attack victim.

Severe Pain - This pain will be over the front of the chest. It may radiate to the shoulder, arm, and hand. The victim may complain of pain or just a numbness in the above-mentioned parts.

Shortness of Breath - This is a usual symptom for any heart victim. Shortness of breath is due to the diminished supply of blood to the lungs. This is a very dramatic and severe symptom.

Apprehension or Fear - This is due to the pain and the thought of impending death. The face will show fright, and the eyes will be opened wide.

Activity and Restlessness - The victim will continuously try to move about and will try to get up. If he is able to be up, he will pace up and down.

Shock - All of the symptoms of shock may be evident. Actually, some victims are in shock during the entire attack.

Passing Out - This may occur in the beginning or later in the attack. It sometimes is the first sign and will be followed by the other symptoms mentioned.

SQUADMEN'S CARE

Severe Pain - For heart attack victims, physicians administer medicine which not only relieves pain but which also relaxes the victim as well as the muscle layer of the blood vessel around the clot. Squadmen are not permitted to give medication. However, if the patient is under medical care the squadmen may assist in administering prescribed medicine which is carried by the victim or is in the household. The squadman can alleviate coronary attack pain by carrying out the steps described in the following paragraphs.

Shortness of Breath - The victim should be given oxygen in the highest concentration possible. The coronary victim is often so afraid and desperate that he will fight the squadman who approaches with the mask, since the victim feels that the mask will smother him. Do not fight with the victim. This only causes the victim's fear to become greater, and in turn, his condition more critical.

If the victim will not take oxygen by mask, disconnect the mask from the outlet and hold the outlet under the victim's chin or in front of his nostrils. In this way the victim will be given a high concentration of oxygen which will tend to make him rest more easily.

Apprehension or Fear - The three big words in squadman care at this time are, "Talk to him." Tell him exactly what will be done and why. Understanding what is being done will tend to alleviate his fear and thus make him relax. The result for which one should strive is the relaxation of the muscular layer of the involved coronary artery.

Activity and Restlessness - There are three words to remember in the care of the victim in this condition: "Do for him." Every effort should be made to keep a heart victim from being active or restless. Being active will put additional stress on his heart. The squadman must not allow the victim to move more than is absolutely necessary. The victim must be kept at rest.

Shock - The care of a heart victim under shock is somewhat different than usual. The three important words to remember are (1) heat, (2) position, and (3) fluids.

1. Heat - Conserve body heat by use of a blanket, but do not make the victim too warm. If the victim experiences a smothering effect from the blanket, do not put the blanket further up than is comfortable. Do not fight the victim.

2. Position - The victim should be placed in the most comfortable position possible. Some victims will feel best lying flat, others in a partial or definite sitting position. Do not fight with them. Care for and transport the victim in the most comfortable position possible.

3. Fluids - Give only small amounts of water to sip, or just moisten the victim's lips. If a victim is given too much fluid, it may cause him to vomit. This in turn will place an additional strain on his heart. The water should not be ice water.

Passing Out - If this should occur during care of the victim, keep a careful watch of the victim's air passage. If the victim should stop breathing, apply artificial respiration immediately, unless mechanical respiration equipment is set up ready to be used. If artificial respiration is applied, it should be replaced by mechanical respiration as soon as the equipment can be checked and put in service.

TRANSPORTATION

In the care of coronary victims it has been stressed that everything possible should be done to make the victim comfortable and to keep him at rest. Transportation of a victim should be carried out at a moderate speed with no siren. It is obvious that a fast trip to the hospital with a blaring siren would not contribute to the well-being of the victim, since it would probably cause him additional fear. The use of oxygen during transportation of heart victims is often very desirable, since it makes breathing easier.

CHRONIC HEART FAILURE

CAUSES

Chronic heart failure is usually due to old age or to a former heart condition that has weakened the heart. Actually, the condition is a weak heart.

The heart is unable to do its usual work. With the lessened supply of blood and poor blood pressure, the victim will have the following symptoms:

1. Wet respiration (noisy)
2. Swollen feet and hands caused by fluid in the tissues
3. Continuous fatigue

The swollen feet and hands are due to the poor circulation. The waste products or materials given off by the body are not carried away from the feet and hands, since the blood pressure from the weakened heart is too poor to push these waste products back up to the heart. These products are then pooled in the tissues of the feet and hands.

With the continual pooling of this waste material, the circulation is further impaired and causes more strain on the heart. The heart tries to pump faster and harder and, then, actually tires out or fails.

SYMPTOMS

Severe Fatigue - The victim may hardly be able to move around. He may be scarcely able to talk. He may look like a person who has just run a long distance.

Shortness of Breath - The shortness of breath is due to congestion in and poor circulation to the lungs by the heart in failure. Since it does not pump enough blood to the lungs, enough oxygen is not supplied to the body. Therefore, the body has a constant need for adequate oxygen. The victim will have long inspirations and long expirations. They will be slow at times and fast at other times. The victim will also have "noisy" respirations due to the poor circulation to and congestion in the lungs.

Swelling of Hands, Ankles, and Feet - This swelling is due to the accumulation of the body waste products in the tissues.

Shock - The victim will be in a condition of shock during the attack; he will exhibit extreme perspiration.

SQUADMEN'S CARE

Severe Fatigue - Since any activity on the part of the victim will cause the attack to become worse, the squadman should attempt to anticipate the victim's every need so that it will be unnecessary for the victim to move.

Shortness of Breath - Oxygen should be used. This type of victim will exhibit oxygen hunger rather than fear or avoidance of it.

Noisy Respiration - This condition can be overcome somewhat by the squadman using the following procedure if the inhalator in service contains a breathing bag.

1. When giving the victim oxygen, let the inhalator bag fill to its capacity.
2. On the next inspiration, squeeze the inhalator bag, keeping the face piece snug to the victim's face.
3. Keep up this procedure, if possible, until the victim is under medical care.

This practice will cause the oxygen to push the excess fluid in the air sacs of the lungs back into the circulating blood. If the inhalator does not contain a breathing bag, it will be impossible to carry out the procedure.

Shock - The usual shock care must be varied for this particular condition.

1. Heat - Because of the usual old age of the victim, do not chill him. Cover the victim and conserve body heat. Do not over-heat him.
2. Position - The victim will want to stay in a position in which his chest is elevated, or in an actual sitting position. Do not force him to lie down; the fluid in his lungs can cause him to drown.

The chronic heart failure victim usually has lived with his condition for years. He may even sleep in a chair, so that his chest will be elevated at all times.

3. Fluids - Give only small amounts of water. The victim will usually want his lips moistened.

After the victim is prepared for transportation, try to keep him comfortable at all times. If his head and chest must be lowered for a short time to carry out transportation, explain this before doing it.

CHAPTER IX

THE MENTALLY DISTURBED PATIENT

INTRODUCTION

Many mildly disturbed persons are about us daily. It is only when their actions are especially unusual that attention is brought to them.

On many occasions the emergency squad is called to attend someone who is behaving oddly. It is paramount that the squadman remember he is to assist disturbed people and not judge or punish them.

This chapter will be divided into two sections. One describes the care of victims who are emotionally disturbed because of disasters and accidents. The other describes victim care for the more usual emotional disturbances that the squad might see.

CARE OF EMOTIONALLY DISTURBED PEOPLE IN LARGE-SCALE EMERGENCIES

The American Psychiatric Association has divided the reactions to large-scale emergencies into 5 categories: (1) normal reaction, (2) individual panic or blind flight, (3) depressed reaction, (4) overly active response, and (5) bodily reaction. Each squadman must understand these individual reactions to an emergency and how to cope with them.

NORMAL REACTION

Symptoms - The experienced squadman has often seen this reaction to emergencies. In fact, a squadman himself may have a normal reaction to an emergency. The signs of this reaction are trembling, profuse perspiration, nausea, and weakness. A victim may be confused. He may experience what is sometimes called "temporary state of shock."

Squad Care - Reassure these people. If you encourage them often, they usually will recover in a short time. They then may be able to assist the squadmen, in the case of a large-scale emergency.

BLIND FLIGHT OR INDIVIDUAL PANIC

Some laymen describe this disturbance as "running wild."

Orderly Exit - It is not thought to be panic if a person or group remove themselves in an orderly way from a dangerous or supposedly dangerous situation. A good example of proper control of panic is fire-drill practice in schools. If children did not practice orderly exits, many might panic in a real emergency, causing the whole class or school to panic. But because of practice drills there is a quick, orderly, normal reaction.

Symptoms - There are a variety of symptoms of individual panic. The victim may attempt to flee from the scene. Squadmen have found uninjured persons running about a scene or away from it. The victim may lose all judgment. He may want to do unreasonable things at the scene which could be done later. He may weep uncontrollably. This sign may come on with little stimulus. For example, at the scene of a home accident someone may be running about wildly and weeping. It may later be found that this victim is not part of the family, but a distant neighbor who happened by and reacted to the injured person in this way.

Squad Care - Be firm but gentle at first. If the victim is so upset that he might cause other people to panic, he should be isolated. This may require the effort of several people.

A panic-stricken victim sometimes can be isolated in the emergency squad vehicle or a police car. If there are injured persons involved, another squad should be called to take the person suffering from individual panic to the hospital. To put this victim in the same vehicle with severly injured people could increase the shock of the injured.

To bring the person with individual panic under control upon your arrival may have a reassuring or calming effect upon many other people. This will contribute to better patient care for all concerned.

Do not strike the panicky victim, or slap him, or throw cold water on him. These methods have been found to be of little help.

DEPRESSED REACTIONS

Symptoms - In the midst of a bad accident scene or disaster, this victim may behave as though there is no one around him. He seems to be "in another world". This behavior has been witnessed many times at large-scale accidents such as explosions, tornadoes, train and bus accidents, etc.

The accident is more than the victim can take mentally, so he shuts the outside world out. He may have a vacant expression, showing no emotions. He may sit or stand without moving or talking.

Squad Care - Do not rush this victim of depression. Your contact must be gentle. Try to get the victim to talk. Ask him what happened.

Finding a routine, simple job for him might help to bring him back to normal. He might help you with simple jobs in caring for patients, such as holding a flashlight, bandages, reports, etc. In a short time he may realize that the disaster is not as great as it seemed, or that he is making a positive contribution by helping the squadmen.

Do not tell the victim to "snap out of it." Do not feel resentful toward him or show resentment. Do not pity him verbally.

OVERLY ACTIVE RESPONSE

Symptoms - This person will be exploding with energy and ideas at the scene. He cannot sit or stand still. He will jump from job to job, hardly ever finishing one. He may joke inappropriately, talk very rapidly, and be argumentative.

Upon arrival, the squadmen may at first think this person is being helpful, but in a short time it will be found that his activities are useless.

By insisting on their own ideas and going from one place to another, these acutely active victims may be a source of opposition to your sound, practiced rescue and emergency procedures.

Squad Care - Under proper supervision these victims can become somewhat composed.

Do not agree with them. Tell them that the rightness or wrongness of your order can be dealt with later. These persons are the first to find fault with anything, and may be very disturbing to the squad members if not supervised.

Their need for physical activity is very urgent. Find jobs for them that use physical activity.

Give them some personal attention. Talk with them for a short time. If they think they are "on your side", they will be of some help to you.

Do not tell them that they "should not feel the way they do."

BODILY REACTIONS

Symptoms - These reactions are different from the normal reactions described in this section. The symptoms include severe nausea and vomiting. Victims may also lose the ability to move their limbs. Loss of sight, hearing, or speech may also occur. These are forms of conversion hysteria: the victims sub-consciously convert their anxiety to a part of their body.

Do not assume that someone who shows symptoms of conversion hysteria is not physically injured, until he has been examined thoroughly.

Squad Care - If a victim believes that a part of his body is injured, treat it as though it is. A splint or other measures may help temporarily.

Show the victim that you are interested in helping him.

Sometimes having a job will help him to forget his disability, and this may lead to recovery and use of the part.

Do not blame or ridicule the victim. Conversion hysteria is not under conscious control.

Do not tell him that there is nothing the matter with him. A victim can be functionally blind or paralyzed, even though the involved structure is uninjured.

SUMMARY

In dealing with any of the five described kinds of reactions, the squadman must establish an effective contact with the disturbed person. Once this contact is made it is reasonably easy to help him.

A victim may exhibit one reaction, and later another. The squadmen must be able to care for all reactions exhibited.

The following general approaches should produce positive results:

1. Accept every person's right to have his own feelings. People do not always act as we want them to.
2. Accept a casualty's limitations (or reactions) as real.
3. Size up a casualty's potentialities as accurately and as quickly as possible.
4. Accept your own limitations in disaster or accident situations.

COMMON MENTAL DISTURBANCES

There are medical conditions commonly seen by squadmen, pertaining to the mentally disturbed patient, and not necessarily related to an accident. Delirium tremens, hysteria, and amnesia are among the most common.

DELIRIUM TREMENS

Delirium tremens is a mental disorder, involving hallucinations both visual and in hearing, commonly called "D. T.s."

This acute type of insanity may be brought on by (1) a prolonged alcoholic drinking spree or a sudden withdrawal of alcohol, (2) an acute infectious disease, or (3) trauma (injury), especially fractures and severe crushing injuries.

Symptoms - The victim usually experiences depression, uneasiness, and insomnia for a day or two. Then coarse shaking develops along with hallucinations, usually involving nonexistent things "seen".

Squad Care - Transport the victim to medical as well as psychiatric care at once, so as to protect him and those with whom he may come in contact. He may see or hear things that are not actually present, and may strike out at these imaginary objects or start to run from them. Squadmen should remember this and not assume that the victim is striking at them.

Try to engage the victim in general conversation. While talking with him, get him into the squad vehicle and transport him. If violence is encountered, you may be forced to restrain him for his own protection as well as that of the squadmen.

HYSTERIA

Symptoms - Hysteria is manifested in many ways. It may be as mild as a headache, or so violent that it brings on self-destruction or personal injury.

The causes of hysteria stem usually from nervous disorders or a sudden psychological shock. Persons in a state of hysteria are usually not aware of their actions. The arrival of an emergency vehicle and the squadmen may cause hysteria to become much worse. Because of this, the proper approach to hysterical patients is most important.

Squad Care - In your speech and movements try to convey a reassuring calmness.

1. Your actions should not be hasty, but deliberate and meaningful.
2. Talk to the victim softly and slowly. All motions should be slow and deliberate.
3. After talking to the hysteria patient in order to win his confidence, arrange to transport him to medical help.

4. Many times, the victim will not consent to ride in a squad car, but will go with members of the family in a private car. If the victim is quiet and acts normally, letting him go with members of the family might be the best move.

5. If the victim is violent upon the squadman's arrival, the squadman must take precautions to prevent harm to himself or the victim. The method of approach described above may be used to get close to the victim. As soon as the squadman is able to grasp the victim, he should do so, but he should first make sure there is plenty of additional help at hand. Some feel it is better to approach the violently ill in numbers from the very beginning.

6. The squadman should try to get these people to medical help quickly.

AMNESIA

Symptoms - The true amnesia victim will act very much like an unconscious person who has been suddenly awakened. The victim may be able to give his name, but he will not remember anything about his past. Some victims will obviously be dazed and will recall neither their names nor their whereabouts. Furthermore, the victim will be slow to move.

The cause of amnesia may be either physical or psychological shock. Usually it is the latter.

Squad Care - Transport the victim to the nearest medical help. He may need psychological care. A physician will be able to arrange appropriate treatment for him.

CHAPTER X

RESUSCITATION

INTRODUCTION

There are two basic methods for administering artificial respiration: manual artificial respiration and the use of mechanical breathing apparatus.

MANUAL ARTIFICIAL RESPIRATION

Over the years, different types of manual artificial respiration have been used. The most common reason for artificial respiration not working is due to the victim's tongue dropping back in the throat or the chin dropping down. These two problems are overcome with the mouth-to-mouth method of artificial respiration. Research has proven that the mouth-to-mouth method is the best type to use. The reason for this is that attention is continually given to the mouth, tongue, and throat area.

MOUTH-TO-MOUTH AND MOUTH-TO-AIRWAY RESUSCITATION

This method of resuscitation is not new. However, it has received acceptance by other than hospital personnel only in recent years. The text and illustrations that follow have been adapted from "A Manual For Emergency Artificial Respiration" by Peter Safar, MD, Chief, Department of Anesthesiology, Baltimore City Hospitals, and Martin C. McMahon, Captain, Baltimore Fire Department, Ambulance Service. The manual was based on research conducted at the Baltimore City Hospital's Department of Anesthesiology, which was supported by the Research and Development Division of the Surgeon General's Office, Department of the Army.

The following information was obtained from recent experiments:

1. The first consideration in any method of artificial respiration is that the air passageway be open; otherwise it is impossible for any air to get into the lungs, regardless of the method used. The air passageway of the unconscious victim is blocked when the neck is bent (chin on chest). The air passageway can be maintained open by holding the chin extended ("sniffing position") and by holding the lower jaw forward.

2. Mouth-to-mouth breathing is superior to all other manual methods of artificial respiration.

3. A pocket-sized S-shaped breathing tube (mouth-to-mouth airway) eliminates the direct mouth-to-mouth contact, and makes mouth-to-mouth breathing more effective, easier, and more acceptable.

4. Mouth-to-mouth and mouth-to-airway breathing can move breaths of 1000 to over 2000 cc of air because (a) the rescuer's hands can hold the victim's head in the "sniffing position" and can support the victim's lower jaw, thus providing an open air passageway, (b) the rescuer can watch the victim's chest and listen to the victim's expirations from which he can determine with each breath whether or not any air is entering the lungs, and, (c) the air can be moved with enough force so that adequate amounts can be moved into the lungs even in obese victims or in a victim whose chest is stiff.

5. Untrained rescuers can perform mouth-to-mouth and mouth-to-airway breathing successfully if certain technical details, described in this manual, are observed.

Some people may wonder how air which has been "used" by the lungs of one person will be any good in artificial respiration. Although the air which the rescuer exhales after a normal breath has slightly less oxygen and more carbon dioxide than the air which he inhales, there is enough oxygen remaining in the rescuer's exhaled air to keep the non-breathing victim alive. During mouth-to-mouth breathing, however, the rescuer is breathing more deeply than normally. As a result of this deep breathing (1) the air which the rescuer blows into the victim's lungs is as good as room air and (2) in addition, the victim receives breaths of a greater volume than he normally breathes. When the rescuer sees the victim's chest move during mouth-to-mouth or mouth-to-airway breathing, the breaths are usually so large that the oxygenation of the victim and the removal of carbon dioxide from the victim are better than when he is conscious and breathing on his own.

RESCUE OF THE UNCONSCIOUS VICTIM

OUTLINE OF METHOD

When the unconscious victim does not breathe, or when he appears to be breathing but his air passageway is blocked (for instance, because his head is not held in the "sniffing position"), his brain dies from oxygen lack within minutes. Therefore, when a victim is found, act within a matter of seconds as follows:

1. Positioning the Victim and Clearing His Throat - Place the unconscious victim on his back, as you must be able to see his face. Move an injured victim cautiously. If there is foreign matter (for instance vomit) visible at the mouth, clear the mouth and throat. (See Figure 1.)

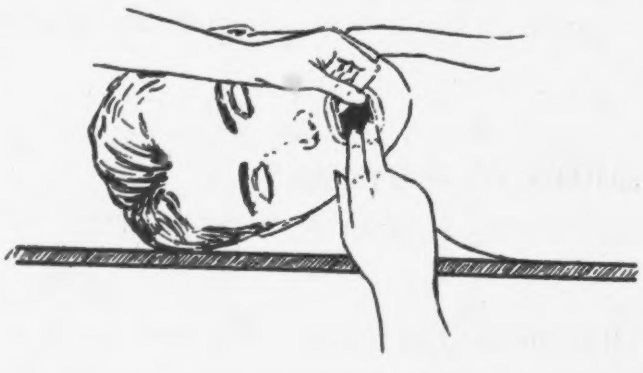


Figure 1

Clearing the victim's mouth and throat.

If no foreign matter is visible, proceed immediately to 2.

2. Opening the Air Passageway (Figure 2 or 3) - Place the victim's head in the "sniffing position" and hold his lower jaw upward. Figure 2 shows the method that is preferred. Figure 3 is the alternate method to be used when the victim's mouth cannot be opened for insertion of the thumb.

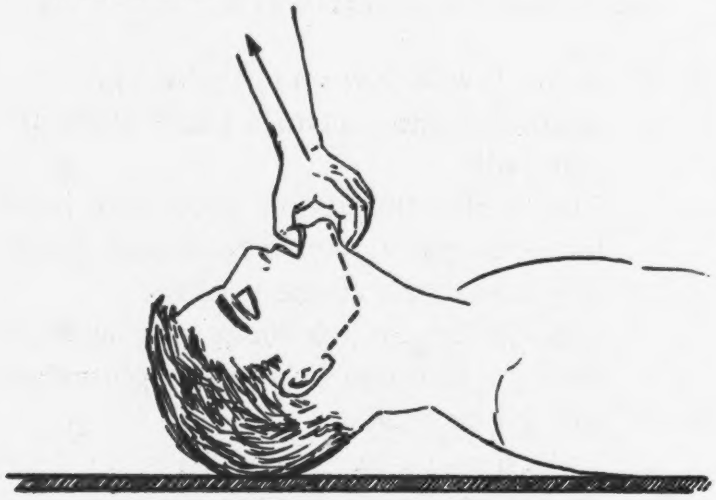


Figure 2

Bringing jaw forward (preferred)

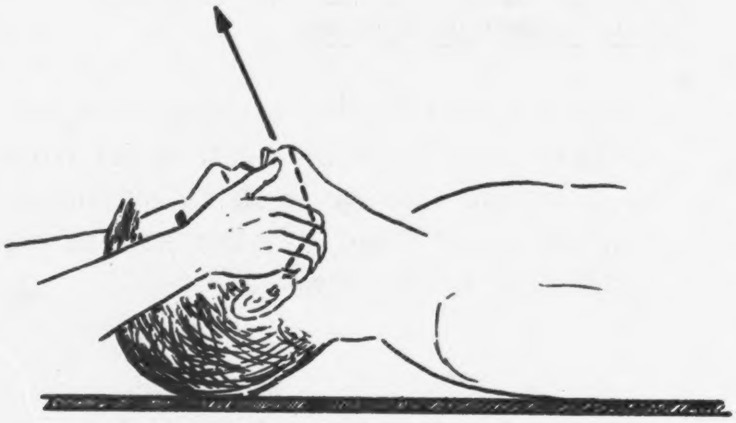


Figure 3

Bringing jaw forward (alternate)

If the victim appears to be breathing naturally, maintain the support of his air passageway until he wakes up. (See Figure 3). When he appears to be breathing naturally, but his tongue is blue or gray rather than pink, start mouth-to-airway or mouth-to-mouth assisted breathing immediately.

3. Artificial Respiration - When the victim is not breathing (chest and abdomen not moving) start mouth-to-airway or mouth-to-mouth breathing immediately and continue until the victim starts breathing naturally or a doctor declares him dead.

If you are carrying a mouth-to-mouth airway, use mouth-to-airway breathing in both child and adult.

If you are not carrying a mouth-to-mouth airway, use the preferred mouth-to-mouth method as shown in Figure 4.

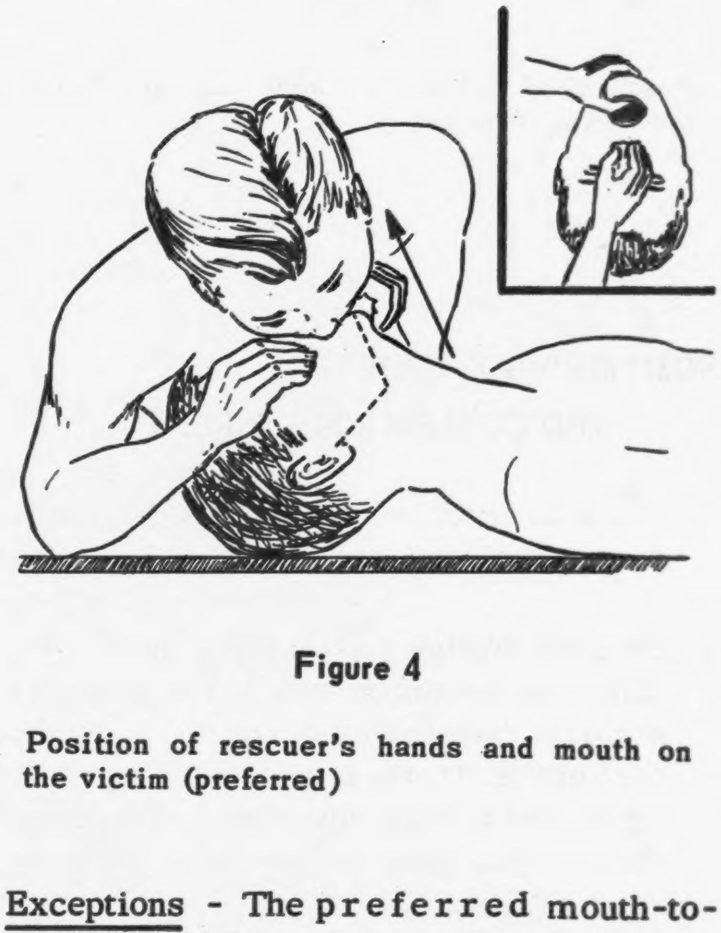


Figure 4

Position of rescuer's hands and mouth on the victim (preferred)

Exceptions - The preferred mouth-to-mouth method cannot be used in the following two instances:

a. In a child less than 3 years in whom your thumb would interfere with mouth-to-mouth contact, because of the small size of the child's mouth.

b. In an adult whose mouth you cannot open for insertion of your thumb.

In these two instances use the alternate mouth-to-mouth method (Figure 5).

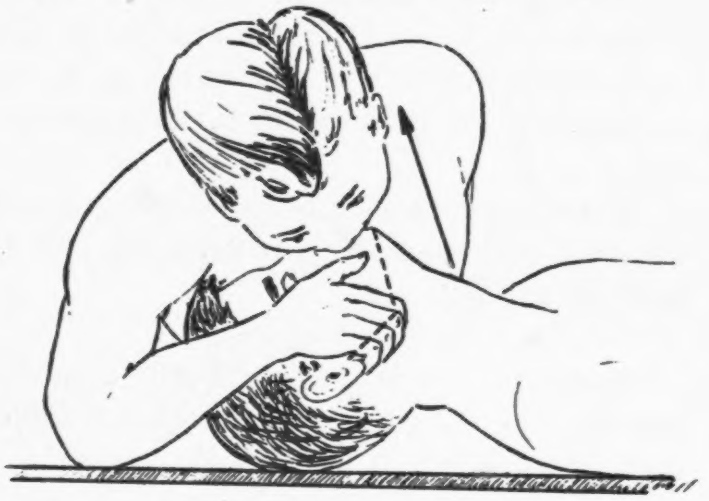


Figure 5

Position of rescuer's hands and mouth on the victim (alternate)

POSITIONING THE VICTIM AND CLEARING HIS THROAT

1. Place the victim on his back (supine). Move injured victim cautiously.

2. Remove foreign matter from the throat. If foreign matter (vomit, blood, phlegm, etc.) is visible in the victim's mouth, turn his head to the side, force his mouth open, and quickly wipe out his mouth and throat with your fingers or a piece of cloth (Figure 1).

You should not spend more than a few seconds doing this, as little time should be lost in getting air into the victim's lungs. If the mouth appears clean, start mouth-to-airway or mouth-to-mouth breathing at once. Whenever it seems necessary, you may repeat the cleaning procedure after either mouth-to-airway or mouth-to-mouth breathing has been started.

OPENING THE AIR PASSAGEWAY

Preferred Method

1. Place the head in the "sniffing position" (Figure 2). Place the head as far back as possible, so the neck is extended. The chin must "lead" and the front of the neck must be stretched.

2. Hold the lower jaw up (Figure 2).
   a. Approach the victim's head from his left side.
   b. Insert the thumb of your left hand between the victim's teeth and grasp his lower jaw at the midline.
   c. Lift the lower jaw forcefully upward so that the lower teeth are higher than the upper teeth.
   d. Hold the jaw in this position as long as the victim is unconscious.

Alternate Method When The Victim's Mouth Cannot Be Opened

1. Place the head in the "sniffing position" (Figure 3). Place the head as far back as possible, so the neck is extended. The chin must "lead" and the front of the neck must be stretched.

2. Hold the lower jaw up (Figure 3).
   a. Approach the victim's head from his left side.
   b. With both hands grasp the angles of the lower jaw just beneath the ear lobes.
   c. Lift the lower jaw forcefully upward so that the lower teeth are higher that the upper teeth.
   d. If the lips are shut, pull the lower lip down gently with the thumbs, but never drop the chin.
   e. Hold the jaw in this position as long as the victim is unconscious.

MOUTH-TO-MOUTH BREATHING

Preferred Method

1. Open the air passageway as shown in Figure 2.

2. Blow air into the lungs (Figure 4).
    a. Close the victim's nose with your right hand (Insert for Figure 4).
    b. After taking a deep breath, place your mouth over the victim's mouth with airtight contact. Do not hold the victim's mouth open widely, as you must take the entire mouth of the victim inside your lips.
    c. Blow into the victim's mouth. Blow forcefully into adults and gently into children.
    d. While blowing, watch the victim's chest. When the chest rises, stop blowing and quickly remove your mouth from the victim's mouth.
    e. Let the victim exhale passively by the elasticity of his lungs and chest.
    f. When the chest does not rise, improve the support of the air passageway (1) and blow more forcefully.
    g. Repeat these inflations 15 to 20 times per minute.

Alternate Method

(For children under three years or for any victim whose mouth cannot be opened.)

1. Open the air passageway as shown in Figure 3.
2. Blow air into the lungs (Figure 5).
    a. After taking a deep breath, place your mouth over the victim's mouth with airtight contact. Cover the nose with your right cheek in order to prevent air leakage. In a baby, cover both the mouth and nose with your mouth.
    b. Blow into the victim's mouth. Blow forcefully into adults and gently into children. In a baby, blow only with small puffs from your cheeks, not from your lungs, to prevent damage to the baby's lungs.
    c. While blowing, watch the victim's chest. When the chest rises, stop blowing and quickly remove your mouth from the victim's mouth.
    d. Let the victim exhale passively by the elasticity of his lungs and chest.
    e. When the chest does not rise, improve the support of the air passageway (1) and blow more forcefully.
    f. Repeat these inflations 15 to 20 times per minute.

MOUTH-TO-AIRWAY BREATHING

This is the method of choice if you are carrying mouth-to-mouth airways. There are two sizes of airways available:

a. Combined child-infant size

b. Combined adult/large-child size

The size of the victim determines which one to use and which end is inserted into the mouth (Figure 6).

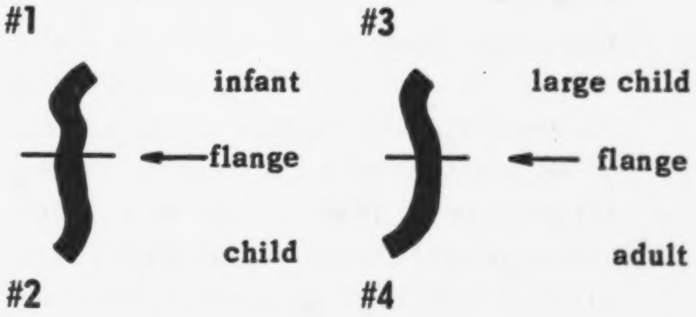


Figure 6

Mouth-to-mouth airways. Note two sizes on each.

Basic Method

1. Insert the airway (Figure 7).

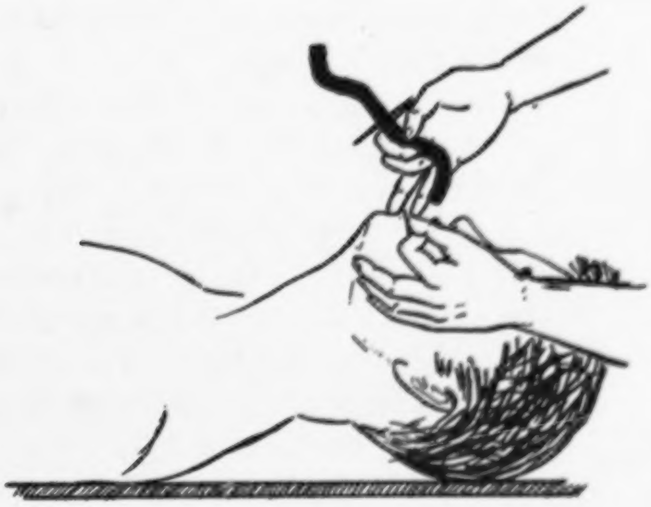


Figure 7

Inserting the airway

a. Approach the victim from the top of his head (vertex).

b. Force the mouth open with one hand.

c. Insert the proper end of the airway along the curve of the tongue with the other hand until the flange comes to rest at the victim's lips. Do not push the tongue back into the throat. If the tongue is in the way, push its base forward with the finger. If the victim is an adult, insert the long end of the large airway (#4); if he is a large child, insert the short end of the large airway (#3); if he is a small child or a baby, insert the short end of the small airway (#1). The part of the airway which remains outside serves as a mouthpiece for the rescuer.

2. Place the head in the "sniffing position" and prevent air leakage (Figures 8,9).

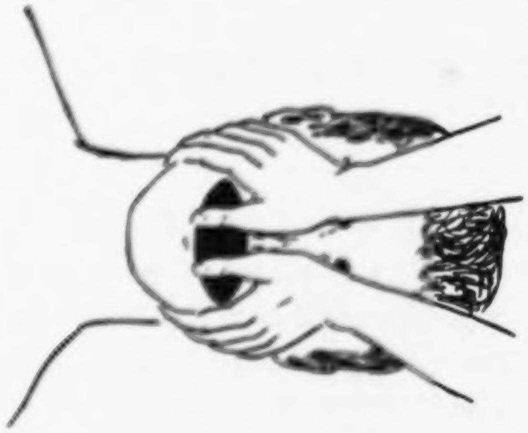


Figure 8

Flange over victim's lips

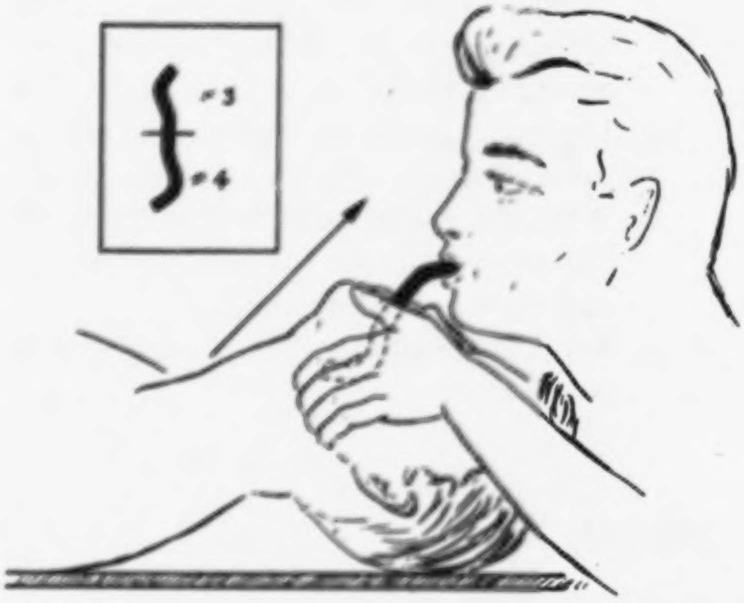


Figure 9

Rescuer is (a) holding victim's jaw up, (b) holding flange airtight, and (c) applying mouth-to-airway breathing.

a. Grasp the jaw with both hands firmly and pull upward (Figure 9). This must extend the neck so the chin is "leading" and the front of the neck is stretched.

  b. Close the victim's nostrils by pressing them together with the large part of your thumbs (Figure 8).
  c. Close the corners of the victim's mouth by pressing the flange firmly against the victim's lips with your thumbs (Figure 8).
     You may prevent air leakage through the victim's nose and through the corners of the victim's mouth by any other desired position of your thumbs and fingers, as long as the victim's head is held in the "sniffing position", so the front of the neck is stretched.

3. Blow air into the lungs (Figure 9).
   a. After taking a deep breath, blow into the mouthpiece of the airway. Blow forcefully into adults and gently into children.
      In a baby, blow only small puffs from your cheeks, not from your lungs, to prevent damage to the baby's lungs.
      In a premature baby, insert the #1 end of the baby airway only partially.
   b. While blowing, watch the victim's chest. When the chest rises, stop blowing and quickly remove your mouth from the mouthpiece of the airway.
   c. Let the victim exhale passively by the elasticity of his lungs and chest.
   d. When the chest does not rise, improve the "sniffing position", prevent air leakage, and blow more forcefully. If the chest still does not rise, readjust the position of the mouth-to-mouth airway.
   e. Repeat these inflations 15 to 20 times per minute.

FURTHER CONSIDERATIONS

When Air is Blown Into the Stomach - After either mouth-to-airway or mouth-to-mouth breathing has been performed for a period of time, the victim's stomach may be bulging. This bulging is due to air which is blown not only into the victim's lungs but also into his stomach. Air inflation of the stomach rarely occurs when the correct technique is applied, but rather will occur more frequently (1) if the air passageway is blocked by improper support of the head and lower jaw, and (2) if the blowing is too forceful.

Air inflation of the stomach is not dangerous, but inflation of the lungs is easier when the stomach is empty. Therefore, when the rescuer sees the stomach bulging, he should interrupt blowing for a few seconds and press with his hand between the victim's navel and breastbone which causes the air to be "burped". Since this maneuver may also make the victim vomit, the rescuer must be ready to clear the throat at once, as shown in Figure 1.

Infection - Experience has shown that there is very little danger of the rescuer becoming infected by the victim. Rescuers who consider direct mouth-to-mouth breathing not to be "sanitary" should use the mouth-to-airway method.

Apparent Natural Breathing

a. The victim may only appear to be breathing naturally by movements of his chest and abdomen, while actually no air may be moving into his lungs due to complete blockage of the air passageway from improper positioning of the head and jaw. Therefore, it is most important to determine whether or not there is any movement of air in and out of the mouth and nose by listening closely or feeling with the fingers in front of the victim's mouth and nose.

b. The victim may breathe noisily (snoring), which indicates partial blockage of the air passageway.

Therefore, even if the unconscious victim appears to be breathing naturally, the rescuer must hold the victim's head in the "sniffing position" and hold the jaw upward at all times (Figures 2 or 3). If an artificial airway is available (for instance the mouth-to-mouth airway), it should be inserted provided that the victim can tolerate it without gagging or coughing (Figure 7). The victim's head must still be held in the "sniffing position". If the victim vomits, the rescuer must clear the throat and mouth swiftly with the fingers (Figure 1). It is extremely important that the rescuer remains at the victim's head during transportation at all times, in order to keep the victim's air passageway open by the methods described above and to start mouth-to-airway or mouth-to-mouth breathing at once when the victim ceases to breathe.

Shallow Breathing and Assisted Breathing

When the victim breathes shallowly, he may not be getting sufficient amounts of air into his lungs. His lips and tongue may appear blue or gray instead of pink. In such cases, the rescuer may deepen the victim's shallow breaths by blowing into the mouth-to-mouth airway or directly into the mouth immediately after the victim starts inspiring. This is called "assisted respiration". The rescuer uses deep inflations of short duration and removes his mouth from the airway or from the victim's mouth rapidly, so as not to interfere with the victim's natural exhalation.

MECHANICAL RESUSCITATION

MAJOR CLASSIFICATIONS OF MECHANICAL BREATHING APPARATUS

Resuscitator

Action - Positive and negative pressure on the inside of the lungs and air passages, accomplished by air-tight circuit with mask and resuscitator.

Used - Only on victims who have stopped breathing.

Inhalator

Action - A steady flow of oxygen from a tank through a reducing valve by way of a mask, catheter or prongs.

Used - Usually (a) on the victim who is just having trouble breathing, or (b) following the use of a resuscitator, when the patient is able to breathe on his own. This inhalator does not breathe for the victim.

Respirator (Iron Lung)

Action - Positive and negative pressure on the outside of the chest. Usually a tank iron lung with pressure on the entire chest wall. It is portable.

Used - Usually on victims who are unable to breathe on their own.

Aspirator (Suction Machine)

Action - As an aid in the use of mechanical breathing apparatus.

Used - To suction out liquids and foreign materials from the victim's mouth and upper respiratory tract. Many times, resuscitation cannot be accomplished without this machine.

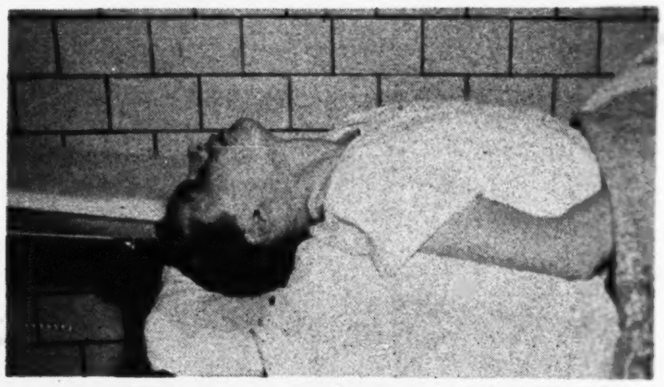
USING THE RESUSCITATOR

Although resuscitators may vary in their operation, the manufacturers are in agreement as to the techniques to be used in applying mechanical artificial respiration.

If manual artificial respiration is being applied at the scene, do not stop until a squadman checks the mechanical resuscitator to see if it is operating properly.

The operation of most machines may be checked by placing the hand over the face piece to see if the blockage signal is obtained.

After the machine has been checked and found to be operating properly, proceed to place the proper size face piece over the nose and mouth of the victim. Stop manual artificial respiration then, and put the machine into service. It is of the utmost importance to place the victim in a position that will tend to keep fluids and other materials out of the breathing passages. This position should allow the operator of the resuscitator to have full access to the victim's face. The inside of the mouth and back of the throat should also be visible so they can be examined easily. To accomplish this, place the victim in a supine position with the head held back and the chin in the "sniffing position". A pillow, folded blanket, or some other object placed under the victim's shoulder blades will help facilitate a satisfactory position for mechanical resuscitation (Figure 10).



Courtesy St. Anthony Hosp.

Figure 10

Position of victim for receiving mechanical resuscitation

Be sure that the victim's mouth and throat are clear. Remove all foreign matter, such as gum, chewing tobacco, loose dentures, or other materials that could block his air passage. If considerable mucus is present, aspirate it immediately to provide a clear air passage.

The efficiency of mechanical resuscitation depends on the successful maintenance at all times of the so-called "closed circuit". This means that an air-tight connection must be maintained between the machine and the victim's lungs. This, in turn, means that there must be air-tight connections within the machine itself, that the mask valves must be closed, and that the mask be air-tight to the victim's face. If the face piece is the type that can be inflated, it should be kept so at all times.

Since most commercially made resuscitators have rubber cushion face pieces, it is relatively easy to create an air-tight connection, provided the position of the squadman's hands upon this mask and the victim's face is the correct one. The thumb and index finger of each hand should encase the mask on the victim's face. This is done by placing them on their respective sides of the mask. (See Figure 11.)

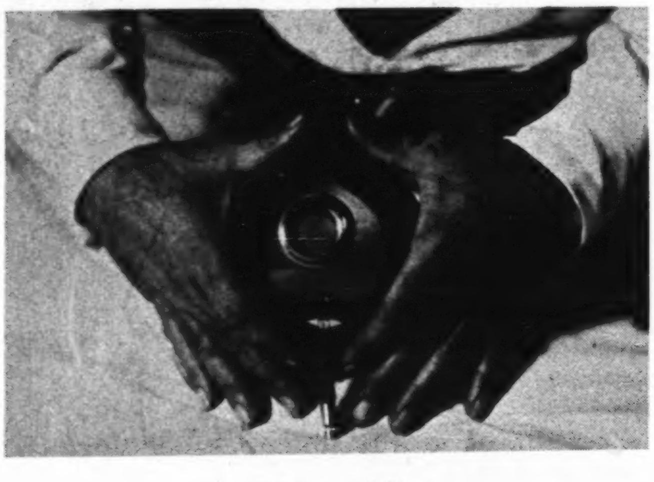
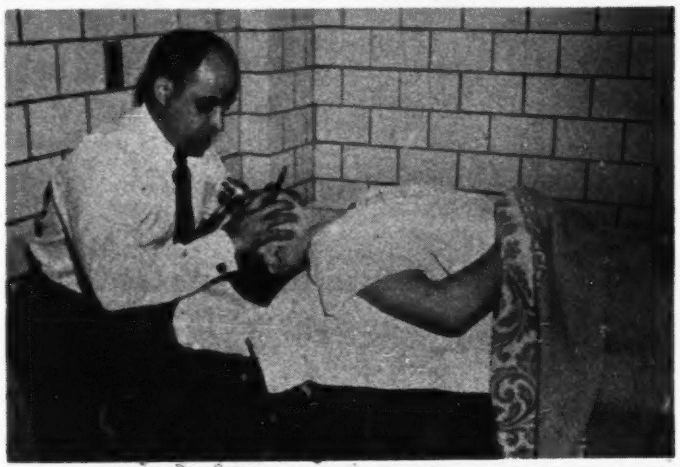


Figure 11

Position of operator's thumbs and index fingers on mask

The other three fingers of each hand grasp the victim's chin from beneath, thus creating a good air passage by opening the windpipe. (See Figure 12.)



Courtesy St. Anthony Hosp. & Millersport F.D.

Figure 12

Position of operator's hands on victim during resuscitation

If the victim has such an injury that parts of the face are missing, or the person's face is sunken from illness or age, or possibly the victim may have his false teeth out at the time of the emergency, the squadman is confronted with a problem. The face piece will not fit tightly against the face, and a closed circuit cannot be obtained. In this case the squadman can secure a closed circuit by applying a moist hand towel or cloth around the face piece. After it is in place, the squadman will put his hands in the usual position, placing them around the cloth and mask. The most desirable position for the operation is, then, at the head of the victim directly behind his forehead.

PROPERLY WORKING MACHINES

If the machine is breathing adequately for the victim, a series of two separate clicks will be audible to the operator. There will be a click from the machine when the oxygen goes in, and another click when the carbon dioxide is pulled out. This positive and negative pressure going in and out of the lungs is called an interval. A regular rhythm of intervals results after the machine begins to breathe for the victim. This is the same kind of rhythm maintained during manual artificial respiration. This rhythm of intervals is the clue which lets the operator know that the machine is working properly, accomplishing the life-saving purpose for which it was manufactured.

BLOCKAGE

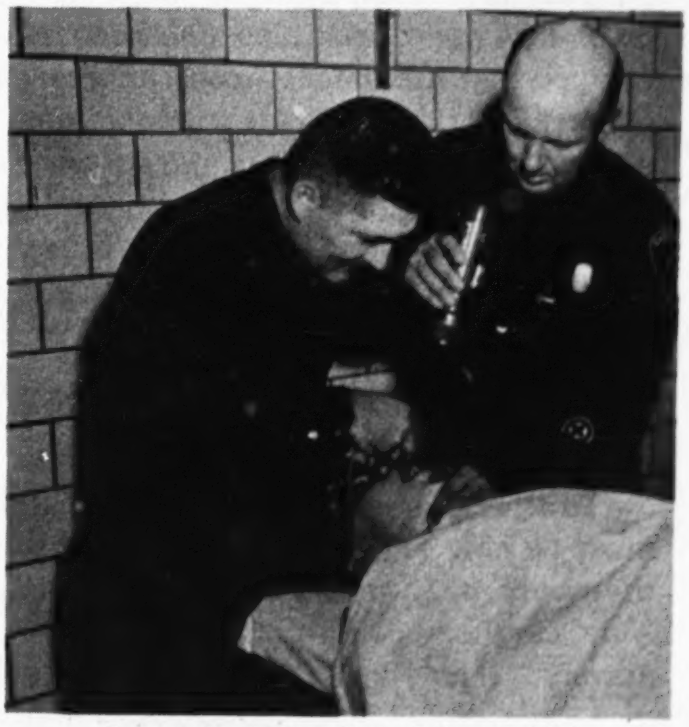
Oftentimes when mechanical respiration is first started, there may occur a fast tripping or clicking sound instead of the regular rhythm. This is caused by blockage. As soon as the blockage signal is heard, remove the face mask and look into the mouth for the possible cause of the blockage. Such blockage or obstruction of the positive and negative pressure may be due to one or more of four things.

A. Presence of Foreign Bodies (Solids) - This includes broken dental plates, gum, chewing tobacco, broken teeth, sea-weed, or any other foreign object in the breathing passages.

It is imperative that such foreign bodies be removed immediately. Since a non-breathing victim is unable to bite, the easiest procedure is to introduce the thumb and index fingers into the victim's mouth to pull out the foreign body. Many squads carry some type of small narrow clamp or forceps that can be used to pick out foreign bodies from the throat (curved Kelly forceps).

B. Presence of Liquids - This includes any form of liquid material that may be in the mouth or breathing passages. It may be blood, water, clear liquid vomitus, or any other liquid material.

As soon as the presence of liquids is noticed in the air passages, the mechanical apparatus should be turned to aspiration if the resuscitator is provided with an aspirator. When suctioning mucus out of a victim's mouth, the suction catheter must be moved about so as to include all areas of the mouth, and so that it will not attach itself by means of suction to the inside of the victim's mouth, thus preventing it from fulfilling its purpose. (See Figure 13.)



Courtesy St. Anthony Hosp. & Greenfield Twp. F.D.

Figure 13

When suctioning a victim, you should have proper lighting (as shown). The victim's mouth should be open wide. The suction catheter should be held securely between the index and second fingers. The catheter should be moved around so it will get all materials and not attach itself against the inside of the mouth.

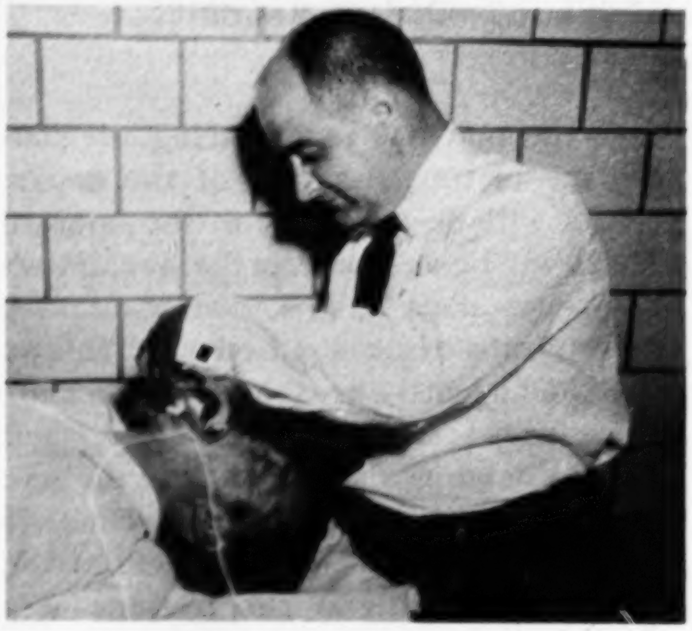
Different sizes of suction catheters should be carried by all squads as additional equipment for resuscitators. A good practice exercise is to use a glass of water and have each squadman practice suctioning water by holding the catheter between the thumb and index finger. The catheter should be held in the same way when suctioning mucus from a victim.

A soft rubber ear syringe may be used instead of a catheter. By squeezing out all the air from the syringe, inserting the tip in the victim's mouth and releasing the bulb, suction is produced and the syringe will act as an improvised aspirator.

C. Tongue - When a person is unconscious or has stopped breathing, he becomes so relaxed that the tongue drops further back in the throat than usual. A common example of this is when a sleeping person snores. The tongue has dropped back in the throat causing a poor air passage which is denoted by a loud sound. In asphyxia victims the tongue actually falls back over the air passage and prevents oxygen from entering the lungs.

To alleviate this blockage, the squadmen must be able to keep the tongue elevated in the mouth, so as not to block the windpipe. This can be accomplished by inserting an airway. (See Figure 14.)

To install an airway properly, the victim's mouth is opened, and the tongue is grasped firmly top and bottom and gently pulled out beyond the lower lip. With the mouth open and the tongue out, the proper size airway is inserted into the victim's mouth. A tongue clamp is a good instrument to use in extracting the tongue; furthermore, the clamp can be carried right in the resuscitator box. In the event a tongue clamp is unavailable, the squadman can pull the tongue out with his fingers.



Courtesy St. Anthony Hosp. & Millersport F.D.

Figure 14

Proper insertion of airway

The best way to ascertain the correct size of an airway is to hold the airway to the side of the face. The lower tip should touch the angle of the chin (just below the ear lobe) and the other end should extend beyond the lips.

The best way to insert an airway is to put its tip against the roof of the mouth, just behind the upper teeth, and slide it down a distance determined by the size of the victim's throat. All airways should be inserted according to the contour of the victim's air passage. Always remember to keep the victim's tongue out of the way while inserting the airway. If the type of airway available is one without lips, tie a six- to eight-inch string or gauze to the end of it.

As soon as the airway is in place, resuscitation should be started.

D. Spasm of the Throat - The vocal cords, which are encased in the "Adam's Apple", are very delicate muscles. Consequently, all respiration problem victims are prone to spasms of the vocal cords. These spasms are known as laryngeal spasms.

Even hospital personnel are at a loss when a patient goes into a laryngeal spasm, and they are forced to take drastic measures by inserting a tube below the vocal cords. This, of course, cannot be carried out by emergency squadmen, and the only last measure that can be used is to give life-saving oxygen to those victims by applying the face mask and leaving the machine on resuscitation. If this is done, a continuous blockage signal will be heard. While holding the face piece in place and receiving the blockage signal, the squadman should pull the head into a backward position and turn it from side to side very slowly. As soon as the machine is able to get past the spasm, it will indicate so by returning to the normal resuscitation sounds. The head position mentioned should be maintained until the victim begins to breathe on his own.

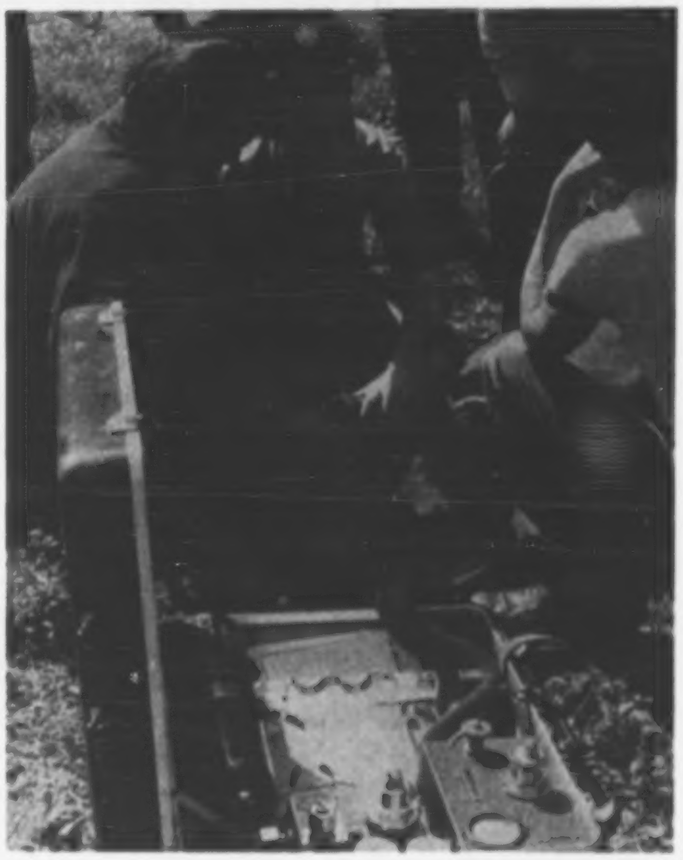
Continual attempts should be made to resuscitate the victim until the victim is pronounced dead by a physician.

SUMMARY

Blockage Cause	Squad Care
Foreign bodies	Pull them out with finger or clamp.
Liquids	Suction with aspirator.
Tongue	Insert an airway.
Spasm of the throat	Turn victim's head slowly from side to side.

USING THE INHALATOR

After the victim starts to breathe on his own, the machine should be turned to inhalation. (See Figure 15.)

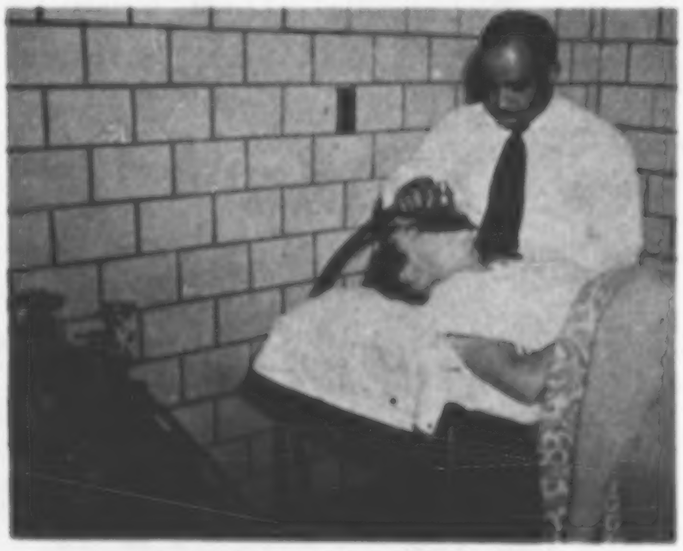


Courtesy Northern Hills F.D.

Figure 15

Fire department emergency squadmen administering oxygen by means of an inhalator to young victim of a near drowning. The mask is held snug to the face and the apparatus is set to administer a sufficient amount of oxygen.

The squadman must watch the victim very closely at this time. If there is an inhalator bag on the apparatus, watch it closely. The rise and fall of the bag will denote the size and rate of the victim's respirations. If there is no bag on the machine, you must watch the victim's respirations by the rise and fall of his chest and abdomen. (See Figure 16.)



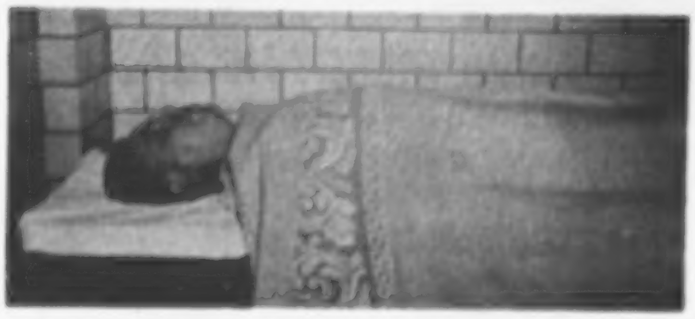
Courtesy St. Anthony Hosp. & Millersport F.D.

Figure 16

This picture illustrates the use of an inhalator after resuscitation. The mask is held lightly but not too tightly on the face. Notice that the squadman is watching the victim closely and has the machine in a position to reach and to watch.

As the victim's pulse, respirations, color, and general condition improve, wean him from the oxygen. This can be done by turning the flow of oxygen down slowly. Let the victim breathe for two or three minutes, then turn the flow down further. If the victim's pulse does not increase, his color stays the same, and his respirations do not increase, the squadman may continue the same routine until the flow of oxygen is nearly off. Take the mask away from the face slightly. This will allow the outside air to mix with the resuscitation oxygen, so that the victim becomes adjusted to breathing outside air.

After he is breathing normally, the victim should be kept prone and remain under observation until he is transferred to the care of a physician or of hospital personnel. (See Figure 17.)



Courtesy St. Anthony Hosp. & Millersport F.D.

Figure 17

After resuscitation, inhalation, and aspiration, the victim is put in a flat position and watched.

EMERGENCY CARE OF THE LARYNGECTOMY VICTIM

The victim who has had his larynx (voice box, also "Adam's Apple") removed requires special emergency care. In Ohio alone there are 2000 people who have undergone laryngectomy. These are people who because of some disease, accident, or other medical condition, have had surgery performed on their voice box with the end result of its being partially or totally removed.

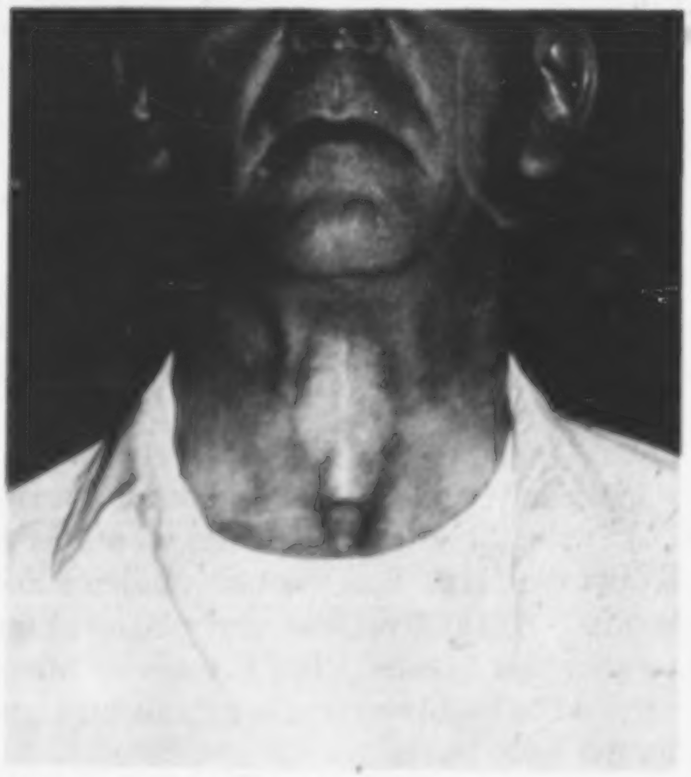
From the time of surgery, these people will never again breathe through their mouths. At the time of the removal of the "Adam's Apple", an opening is made at the lower part of the neck, just above the breast bone. It is through this opening that the "laryngect" must breath for the remainder of his life. They are commonly referred to as "the neck breathers".

As shown in Figure 18, a patient's neck is exposed and the "stoma" (permanent opening in the neck to the windpipe) is visible.

If his shirt were closed, or he had on a T-shirt or a shirt and tie, the stoma would not be easily seen.

Women with stomas wear high necklaces. These partially cover the opening and unless closely investigated, it might be overlooked.

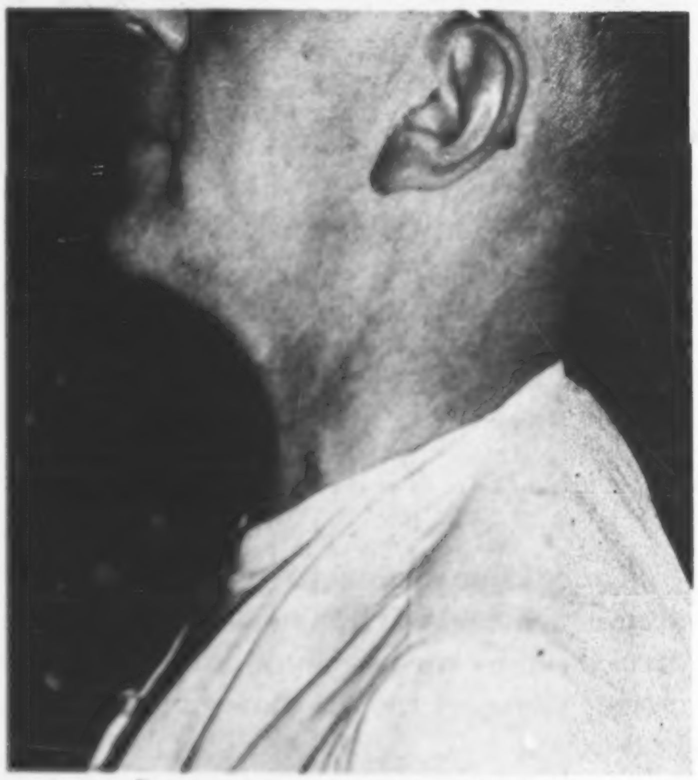
A side view of this man (Figure 19) shows that he does not have an "Adam's Apple". This is one good way to tell a "neck breather". You could obstruct this man's mouth and nose for hours and it would not disturb him, as he does not breathe through them.



Courtesy Clinton Twp. F.D. & Franklin Co. Cancer Soc.

Figure 18

After laryngectomy, man receives air into his lungs through neck opening (stoma).



Courtesy Clinton Twp. F.D. & Franklin Co. Cancer Soc.

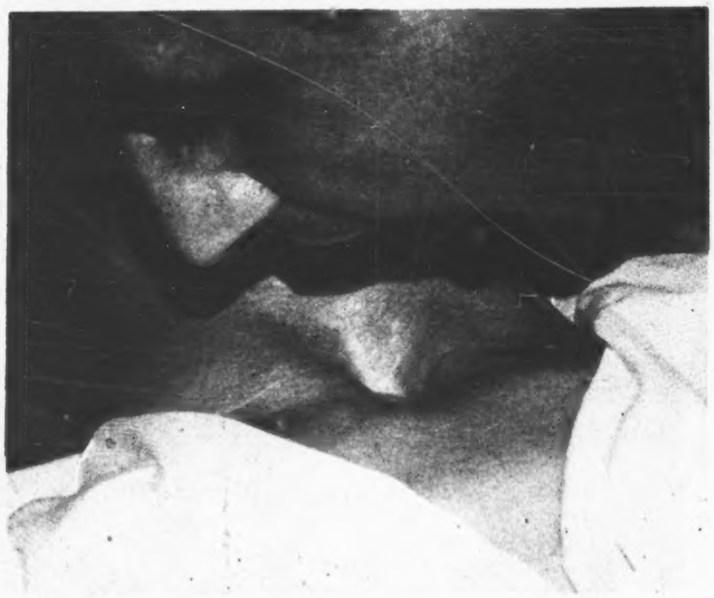
Figure 19

The absence of an "Adam's Apple" indicates that this man may be a neck breather.

RESUSCITATING THE VICTIM

If this type of victim should stop breathing, the squadman would use the manual or mechanical artificial respiration that is used routinely, but it must be applied over the stoma.

As shown in Figure 20, the squadman must give mouth-to-stoma resuscitation with the victim on his back and the chin up out of the way of the stoma. Placing his mouth over the stoma, he would give mouth-to-stoma resuscitation following the procedure he has learned for the mouth-to-mouth method.



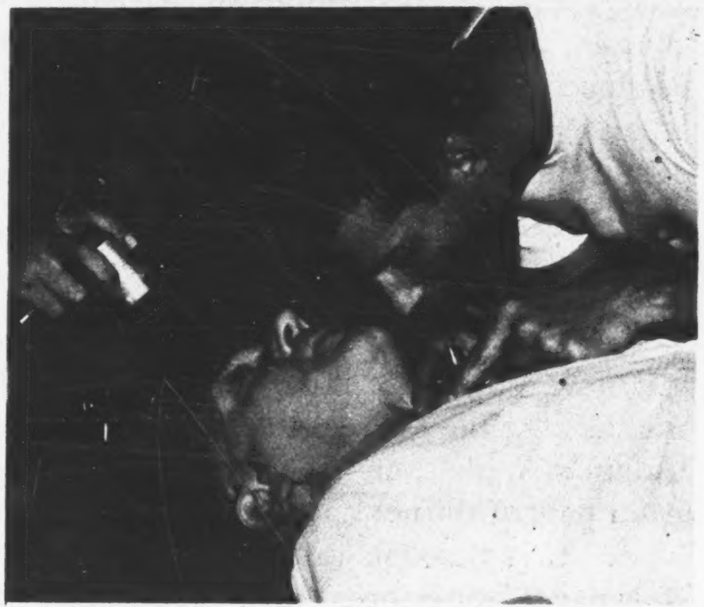
Courtesy Clinton Twp. F.D. & Franklin Co. Cancer Soc.

Figure 20

Mouth-to-stoma resuscitation is given.

There is no problem of air going into the stomach because the squadman breathes directly into the windpipe. The tongue cannot obstruct the air flow, as the stoma is below it.

If the mechanical resuscitator is readily available, the use of the BABY mask over the stoma followed by mouth-to-mask resuscitation will aerate the victim adequately. The squadman in Figure 21 is carrying out this procedure until the resuscitator can be readied.



Courtesy Clinton Twp. F.D. & Franklin Co. Cancer Soc.

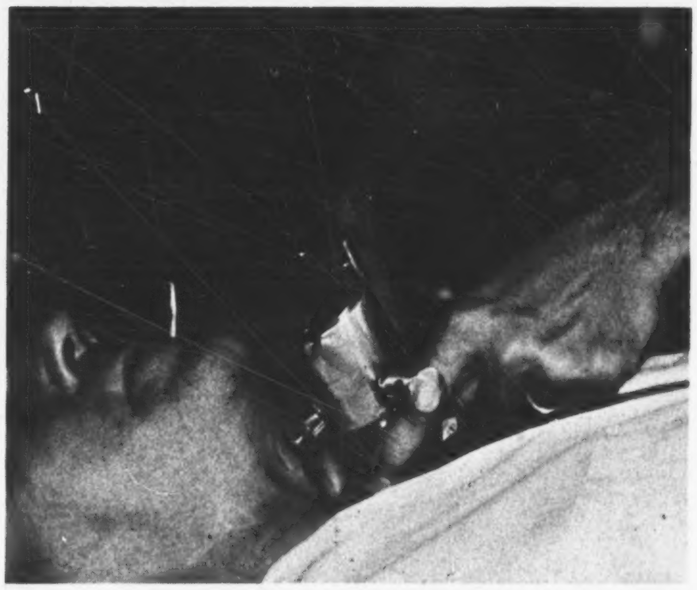
Figure 21

A baby-size mask must be used over the neck opening for mechanical resuscitation.

If the mask will not fit airtight, a moistened towel can be placed around the mask to seal off any openings. All face pieces of your resuscitation equipment should be inflated at all times.

When the resuscitator is put into service, it should be held over the stoma as it is over the face, with the index fingers and thumbs. A folded blanket can be used under the shoulder blades. The blanket or other material helps to keep the windpipe straight and the head back.

Elevation of the chin by use of the blanket under the shoulder blades will also make the procedure easier. The squadman in Figure 22 has the victim positioned correctly and is holding the mask properly.



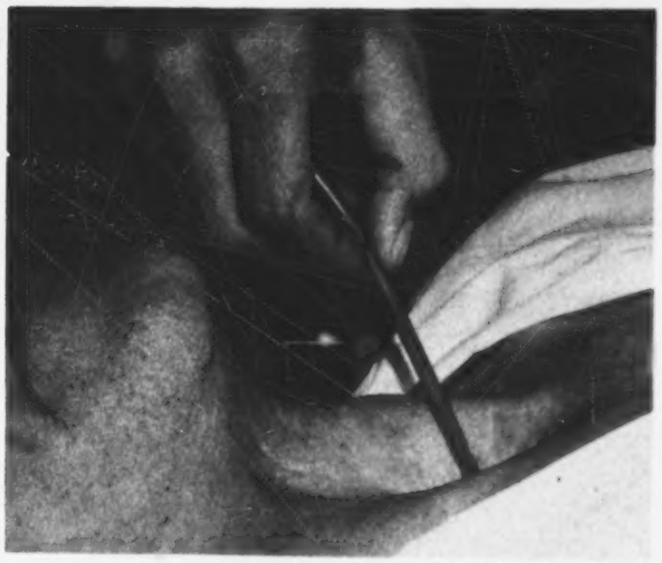
Courtesy Clinton Twp. F.D. & Franklin Co. Cancer Soc.

Figure 22

The resuscitator breathes for the patient.

This type of victim is much easier to aspirate (suction) than the average resuscitation victim. If the resuscitator gives the blockage signal, mucus will be the usual cause.

The squadman must be sure to rotate the catheter as he suctions. The squadman in Figure 23 is doing so by rotating the aspirator tube between his thumb and index finger. The catheter should be pinched off as it is inserted into the stoma preventing damage of it.



Courtesy Clinton Twp. F.D. & Franklin Co. Cancer Soc.

Figure 23

An aspirator tube, inserted through the stoma, will remove mucus.

There are clubs throughout the nation called the "Lost Cord Clubs". These clubs are sponsored by the American Cancer Society. They are very interested in each squadman being keenly aware of their problem. When patients are released from the hospital with stomas, they are told to make themselves known to their local squad.

When a laryngectomy victim is released from the hospital, he may be cured and live a normal life. The victim who posed for these pictures has had a stoma for many years.

There is always the additional problem of visitors to your area who might be "neck breathers". The theme for the squadmen is becoming "CHECK THE NECK FOR THE LARYNGECT".

ADJUNCTS TO RESUSCITATION

BAG RESUSCITATOR

Figure 24 shows a new type of resuscitator. It is light in weight and reinflates itself. A flow of oxygen can be added to the tip on the end of the bag. It can be brought into use quickly.

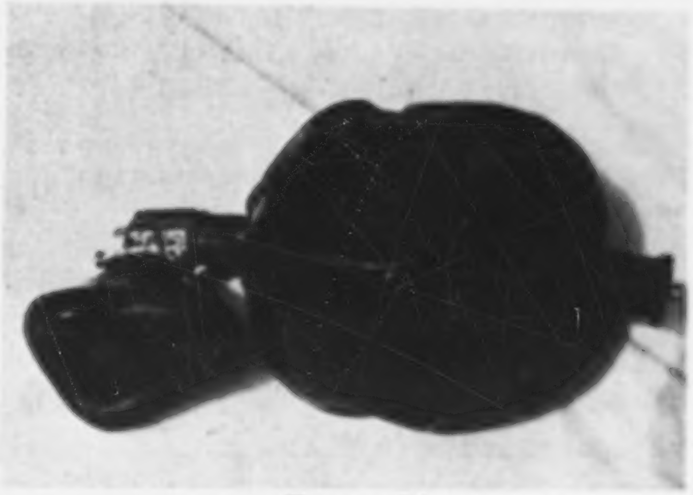


Figure 24

Bag resuscitator

MOUTH-TO-MASK RESUSCITATOR

An adjunct to mechanical resuscitation is shown in Figure 25. This type of apparatus does away with the direct contact in mouth-to-mouth breathing. It is light and can be put into use before the larger mechanical resuscitator can be brought to the victim.

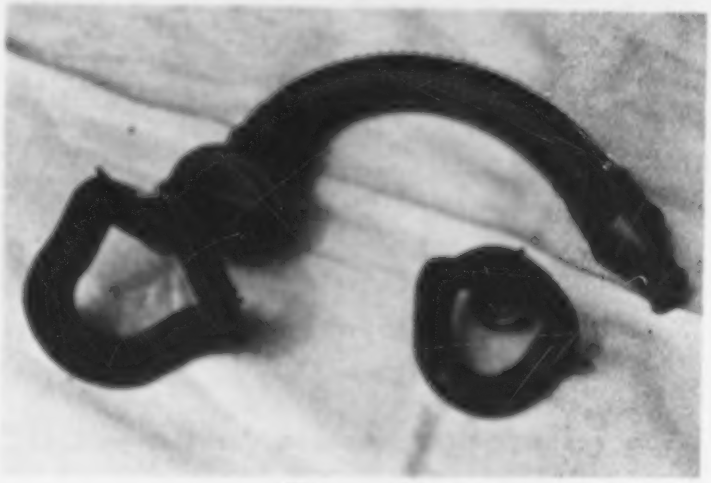


Figure 25

Mouth-to-mask resuscitator

EXTRA EQUIPMENT

There are six extra items of equipment that should be carried with each resuscitator:

1. Flashlight - A light is needed to examine the victim's throat when blockage is encountered.
2. Suction Catheters - Each resuscitator should carry a variety of whistle-tip suction catheters. The recommended sizes are: 12, 14, 16, 18 and 20 French. With these sizes the squadman should be able to handle all problems of suctioning.

3. Airways - Each resuscitator should be provided with seven airways, as follows: Large, medium, and small adult; large medium, and small child; and the newborn size. Measuring from the edge of a victim's mouth to the end of his jawbone (under the ear) will indicate the needed size. Plastic or rubber airways are preferred. (See Figure 26.)

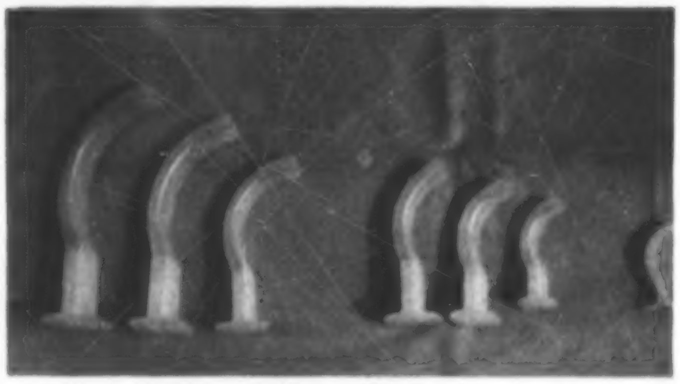


Figure 26

Airways: three adult sizes, three child sizes, and a newborn size.

4. Cloth hand towel - A small tea towel or hand towel should be available (not a turkish towel.) The towel can be used as a seal around the face mask of the resuscitator, for cases when the mask will not fit tight around the face. Moisten the towel and fold it; then fit it between the mask and the rescuer's hands.

5. Curved Kelly Hemostat - When the squadman cannot remove a foreign body in a victim's throat with his fingers, an instrument should be available for reaching into the throat to grasp the object. The curved Kelly Hemostat (sometimes called Kelly clamp) is the proper instrument. (See Figure 27.)

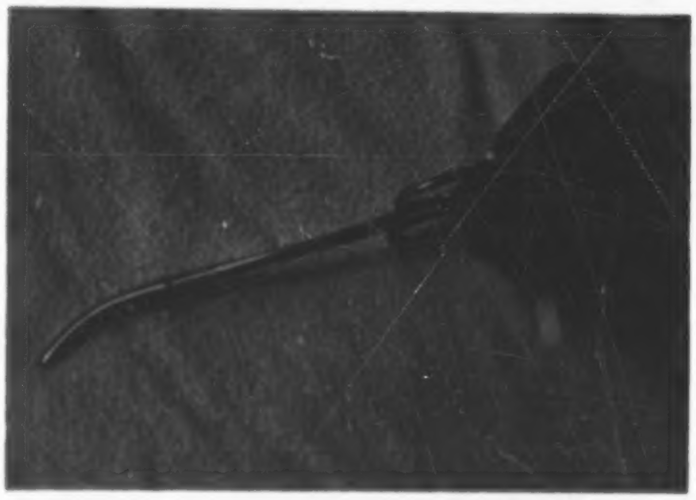


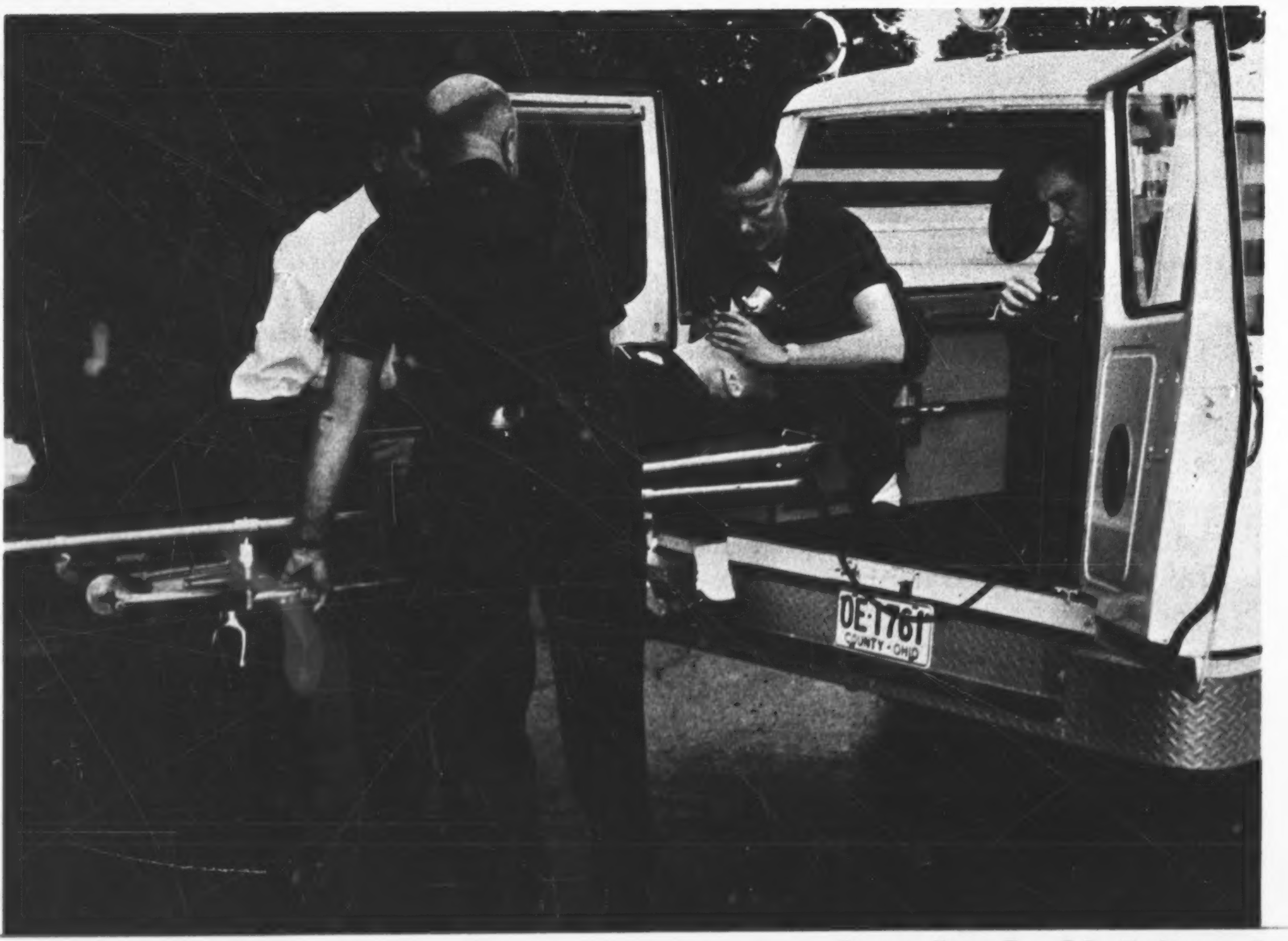
Figure 27

Each resuscitator should have a medium curved Kelly Hemostat or clamp. This instrument is curved to match the contour of the throat. It will easily grasp a foreign object so that it can be pulled out.

6. Aspirator Bottle - One extra aspirator bottle should be carried on the squad vehicle at all times, in case the bottle that is in use should crack or break.

RESUSCITATION WHILE TRANSPORTING

If all the appropriate steps in resuscitation, as previously described, are carried out properly, the patient can be resuscitated during transportation without difficulty. (See Figure 28.)



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 28

Squadmen continue resuscitation while victim is being loaded into vehicle for transportation to hospital.

CHAPTER XI

OXYGEN THERAPY

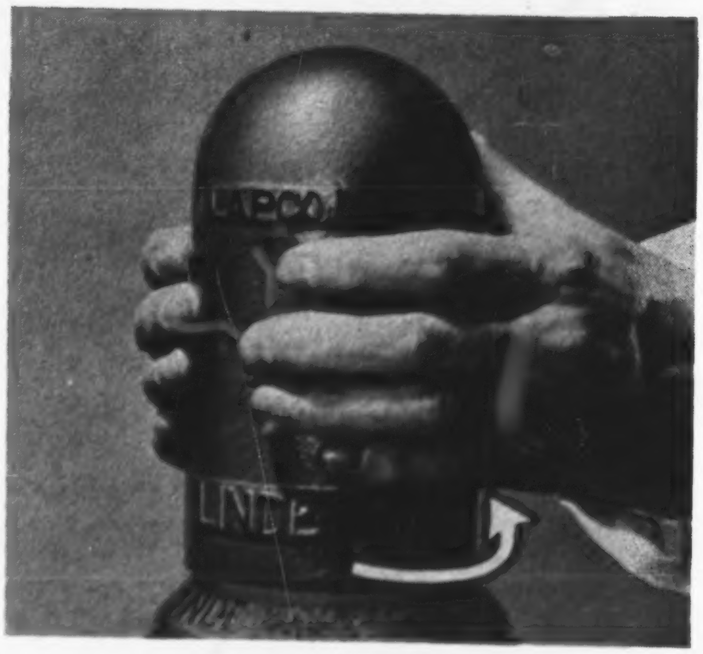
INTRODUCTION

Among the most basic equipment to be placed in the average emergency squad vehicle is the apparatus for administering oxygen. Many of the victims cared for by squadmen have a great need for highly concentrated oxygen. Alone or in support of other measures, it is important in emergency care of such conditions as heart attacks, severe burns, loss of blood, respiratory distress and shock. Oxygen administered with an inhalator or resuscitator can prevent the condition of victims from being much worse, or may even ward off death.

BASIC PROCEDURE

SETTING UP THE APPARATUS

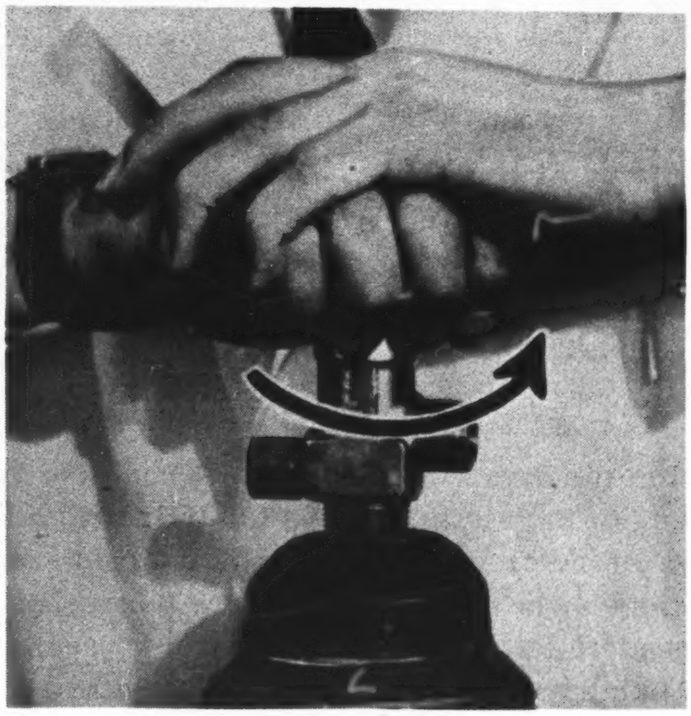
In preparing a cylinder of oxygen for use, the protective cap must be removed (Figure 1). Then, with the valve outlet pointed away from the operator and with a firm grip on the cylinder, open the valve slightly (Figure 2), then close it quickly (Figure 3). This is called "cracking" the valve. In this manner dust which has lodged in the valve opening is cleaned out, so it will not enter the regulator.



Courtesy Linde Co.

Figure 1

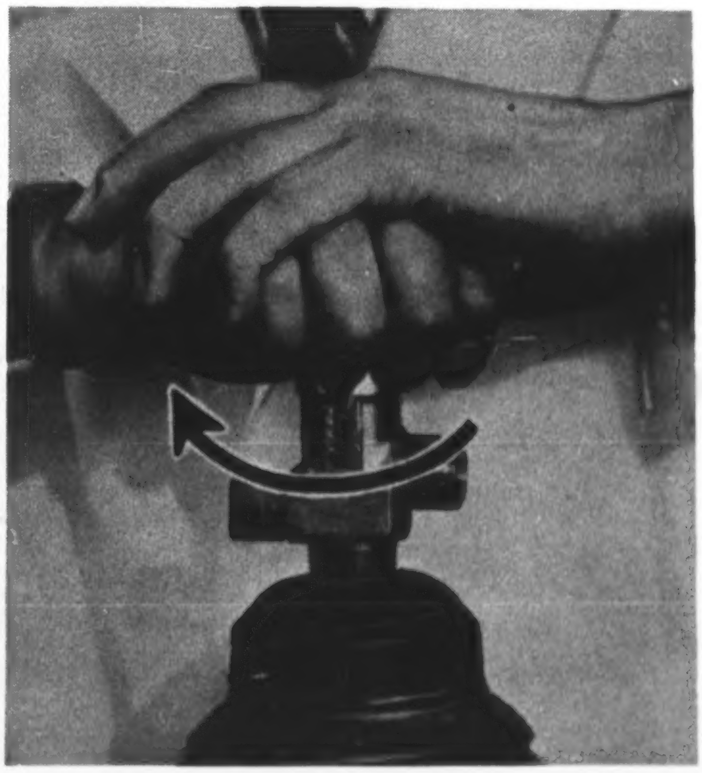
Remove protective cap.



Courtesy Linde Co.

Figure 2

Open valve slightly.



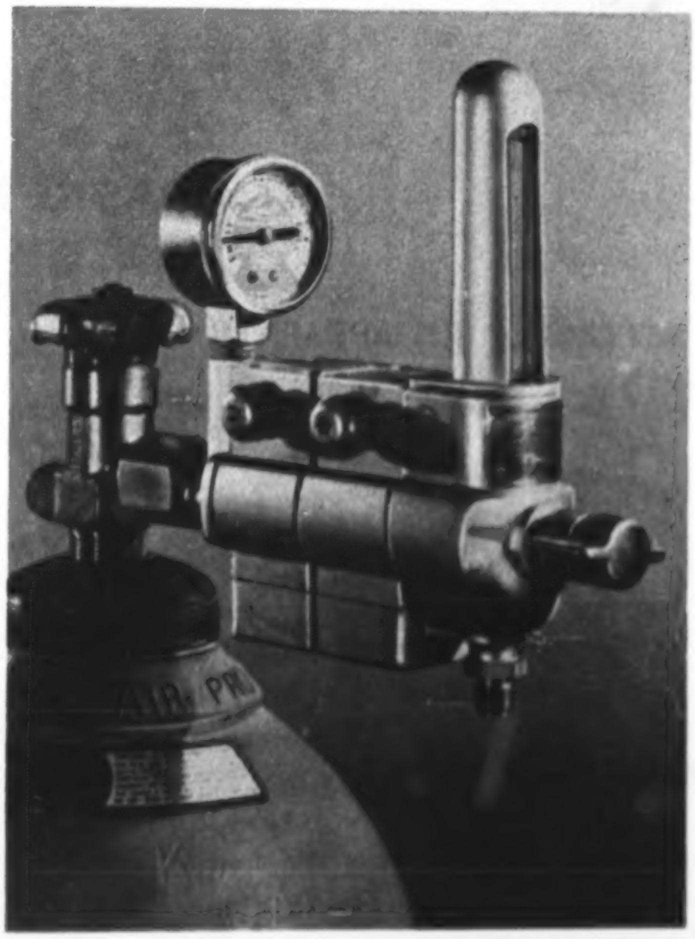
Courtesy Linde Co.

Figure 3

Close valve quickly.

Reducing Pressure - When an oxygen tank is full, it is under a pressure of more than 2,000 pounds per square inch. Before we may use it safely, a pressure-reducing regulator must be attached to the tank. This will permit giving oxygen to the victim at a much lower pressure.

Controlling Flow - Figure 4 shows one widely used type of regulator. After the oxygen leaves the pressure-reducing valve, it flows through an adjustable flowmeter (Figure 4). This permits administering oxygen to a victim at the rate desired.

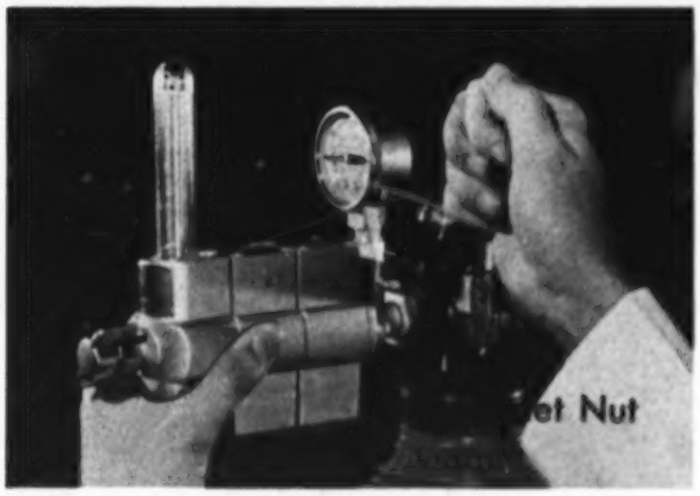


Courtesy Linde Co.

Figure 4

A pressure-reducing regulator must be attached to the cylinder before oxygen can be administered to the patient.

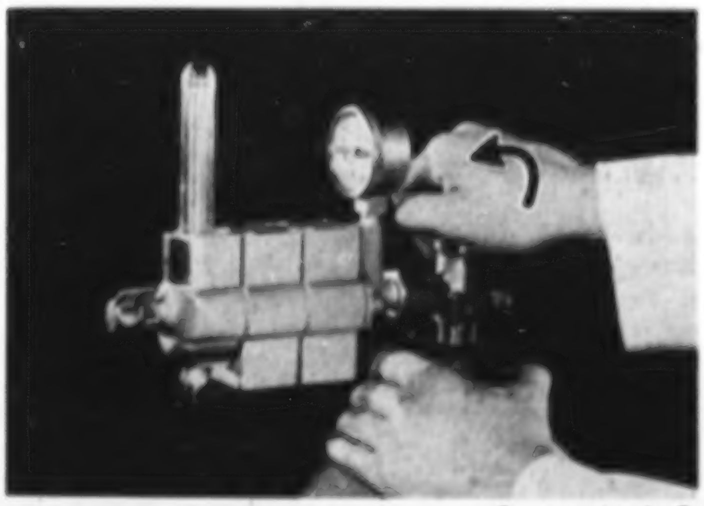
Figure 5 shows the regulator-flowmeter being attached to an oxygen tank. Figure 6 shows the regulator ready for use.



Courtesy Linde Co.

Figure 5

Insert regulator inlet in cylinder valve outlet and tighten the inlet nut with a wrench.

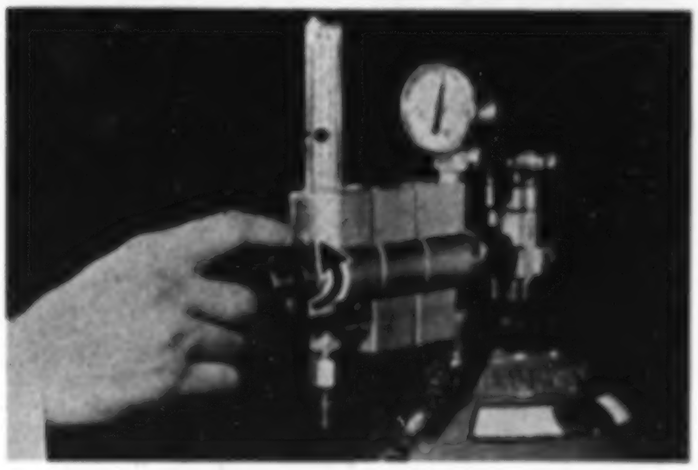


Courtesy Linde Co.

Figure 6

Stand to one side of the regulator—opposite relief valve—not in front or in back of it. Open cylinder valve very slowly—the slower the better—until needle on cylinder-contents gauge stops moving. The ball float will rise in the tube for a moment and then quickly return to zero. This indicates that oxygen has entered the flow indicator tube.

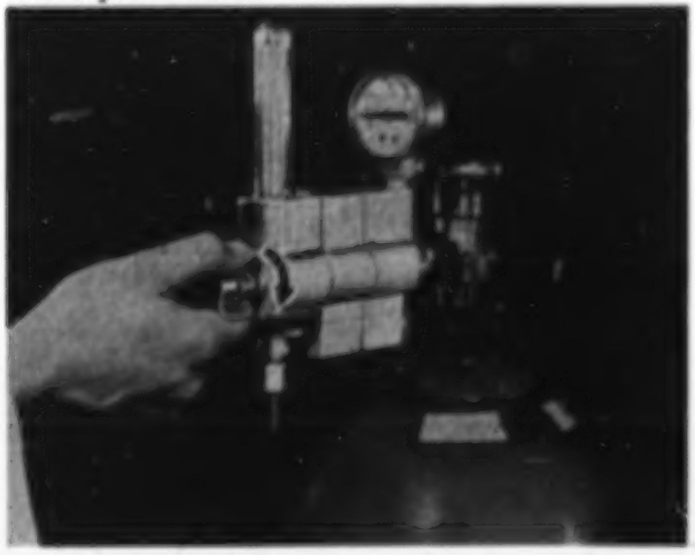
To administer oxygen, attach the administering apparatus to the regulator outlet and adjust the oxygen flow (Figure 7) to produce the desired concentration. To stop the flow for short periods - less than one-half hour - simply close the flow adjusting valve (Figure 8). Cylinder content will continue to register.



Courtesy Linde Co.

Figure 7

Open the flow-adjusting valve. The ball float will rise in the tube. The position of the top of the float indicates the rate of flow in liters per minute.

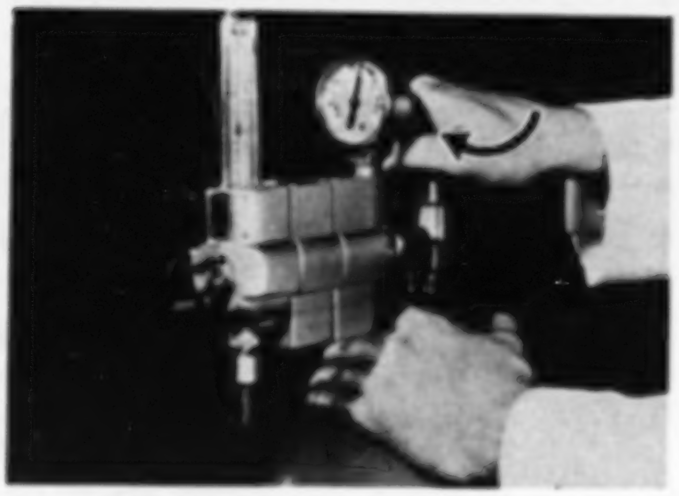


Courtesy Linde Co.

Figure 8

Stop flow by closing the flow-adjusting valve. The float will drop to zero.

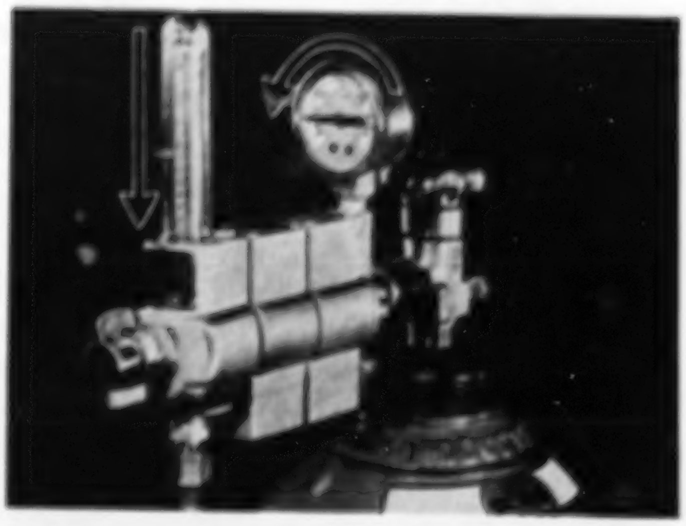
When the flow of oxygen is to be discontinued for one half hour or more, or when the regulator is to be disconnected from the cylinder, follow the steps outlined in Figures 9 and 10. Then close the flow-adjusting valve as in Figure 8.



Courtesy Linde Co.

Figure 9

Close the cylinder valve tightly. Then open the flow-adjusting valve.

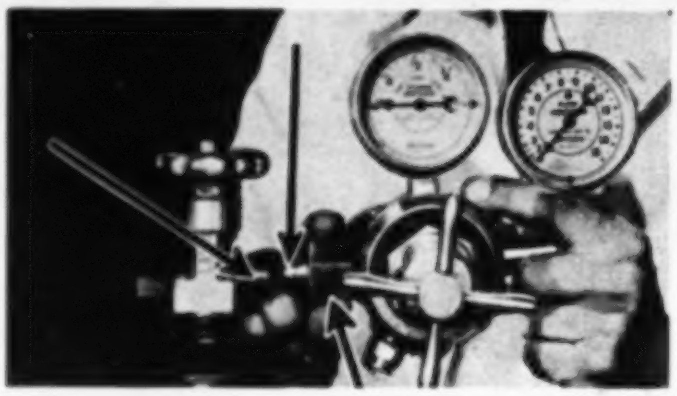


Courtesy Linde Co.

Figure 10

Wait until both cylinder-contents gauge and liter-flow indicator have returned to zero. Then close flow-adjusting valve.

Cross-Arm Regulators - Another type of regulator in wide use operates somewhat differently. It has two gauges; one shows cylinder contents and the other shows the rate of flow. Figure 11 shows how to install one of these regulators on a tank.

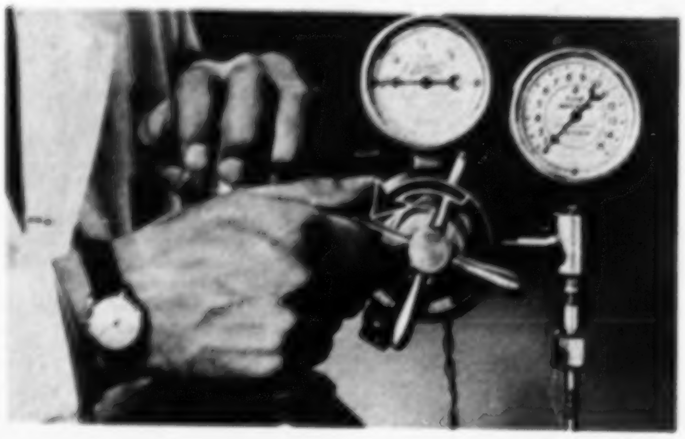


Courtesy Linde Co.

Figure 11

Insert regulator inlet into cylinder outlet and tighten inlet nut with a wrench.

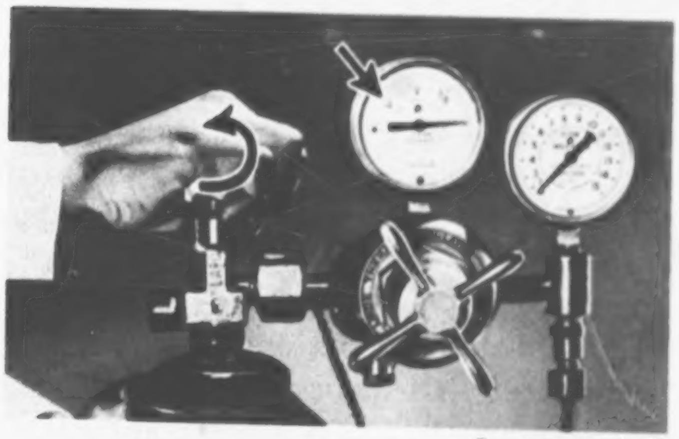
Before oxygen is administered, the flow-adjusting handle must be loosened (Figure 12), and the cylinder valve must be opened very slowly (Figure 13).



Courtesy Linde Co.

Figure 12

Loosen regulator flow-adjusting handle. This is important and should be done before opening the cylinder valve.

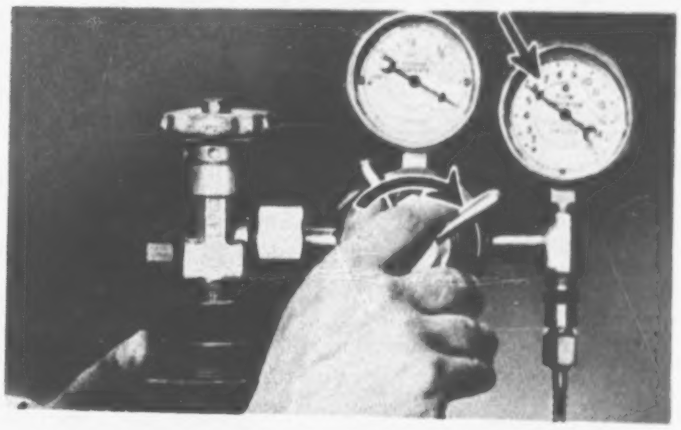


Courtesy Linde Co.

Figure 13

Stand on side of cylinder opposite regulator side. Do not face either front or back of regulator. Open cylinder valve very slowly until needle on cylinder-contents gauge stops moving.

To administer oxygen as needed, follow the directions under Figure 14.



Courtesy Linde Co.

Figure 14

Tighten flow-adjusting handle by turning it to the right until the flow-indicator gauge registers the desired rate of flow in liters per minute.

To stop the flow of oxygen for short periods - less than one-half hour - simply loosen the flow-adjusting handle by turning it to the left until the flow indicator returns to zero. Cylinder contents will continue to register.

When the oxygen flow is to be cut off for $\frac{1}{2}$ hour or more, or when the regulator is to be disconnected from the cylinder, proceed as in Figures 15, 16, and 17.

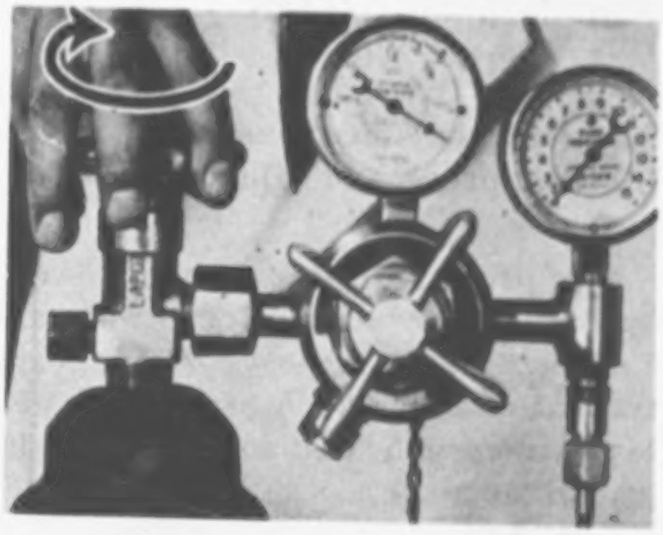


Figure 15

Courtesy Linde Co.

Close cylinder valve tightly. Then open the flow-adjusting valve.

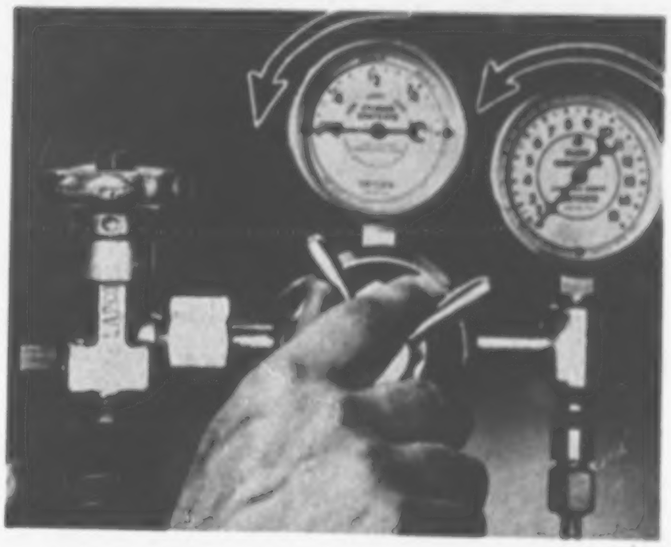


Figure 16

Courtesy Linde Co.

Wait until both cylinder-contents and liter-flow needles have returned to zero.

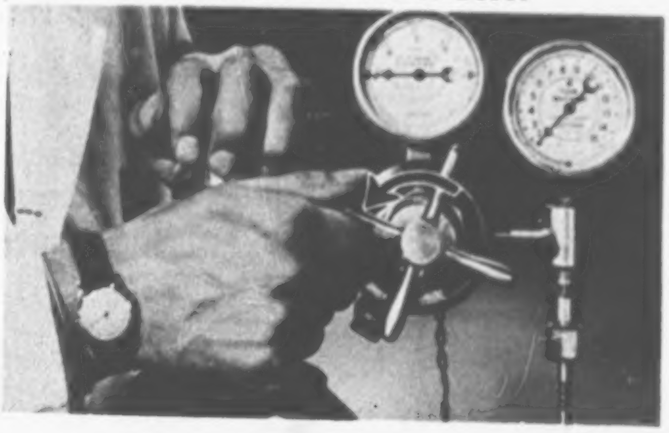


Figure 17

Courtesy Linde Co.

Loosen regulator flow-adjusting handle. This is important and should be done before opening the cylinder valve.

ADMINISTERING OXYGEN

Methods - Oxygen may be given in four ways: (1) full face mask, (2) catheter, (3) nasal prongs, or (4) tent.

The preferred method of administration by a squad is by mask. The reason is that a mask gives the highest possible concentration to the victim. A problem in the use of this method is that some victims have fear of the mask.

The next preference is the catheter. This method is being used more frequently by squads today that in the past. The catheter does not provide the highest concentration of oxygen, but the victim is more comfortable and is not frightened, as he may be by a mask.

Another method sometimes used is the nasal cannulas or prongs. This method is least desirable due to the low percentage of oxygen the victim can receive.

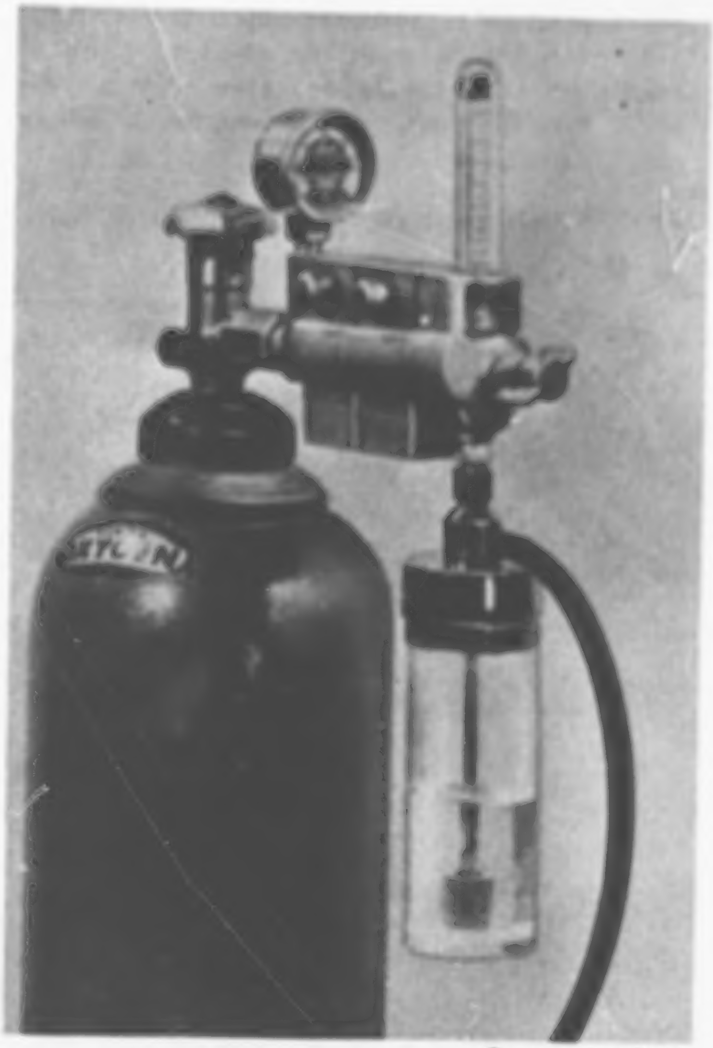
Few squads use tents. This method lends itself to use over long periods of time and needs close supervision; therefore it is seldom used by squadmen.

The concentration of oxygen possible with each type of administering apparatus is as follows:

Mask - approaching 100% concentration
Catheter - 40% to 60% concentration
Nasal Cannulas - 30% to 50% concentration
Tent - 40% to 60% concentration

It can readily be seen that the use of a mask is the best method, since it provides the highest concentration of oxygen. An emergency squad need have no fear of over-oxygenating an acute victim.

Humidity - Since squads give oxygen for relatively short periods of time, they are not required to use humidifiers. However, when oxygen is given over a prolonged period, it has a tendency to dry the membranes of the nose and throat. If oxygen is to be administered for many hours by squadmen, it is a good idea to run the oxygen through water to humidify it (Figure 18). Membranes will not dry as fast this way and the victim will remain more comfortable.

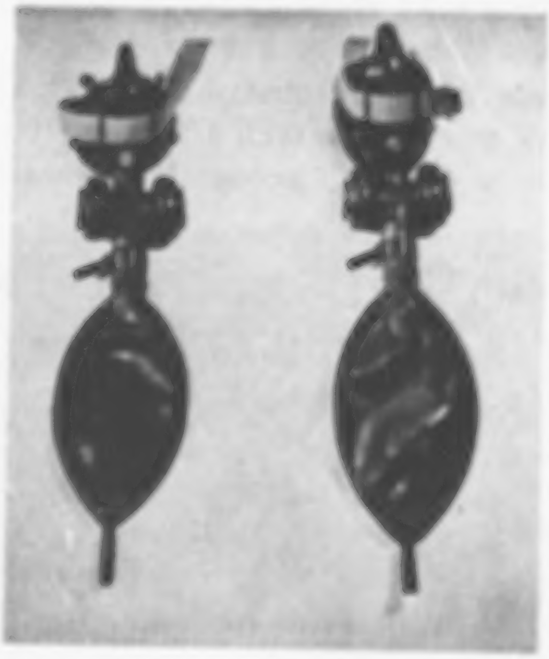


Courtesy Linde Co.

Figure 18

A humidifier with a diffuser head.

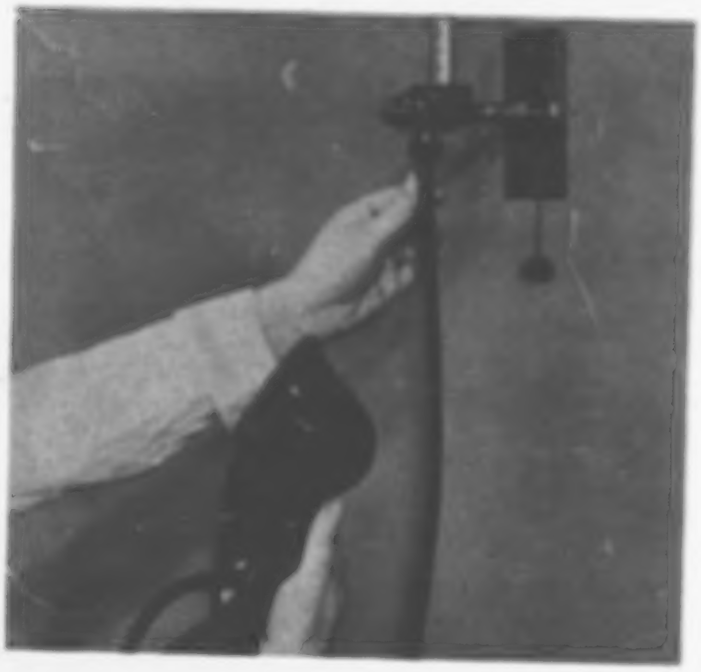
Face Masks - Figures 19 through 22 show how to choose a mask, connect it, set the oxygen flow, and apply the mask.



Courtesy Linde Co.

Figure 19

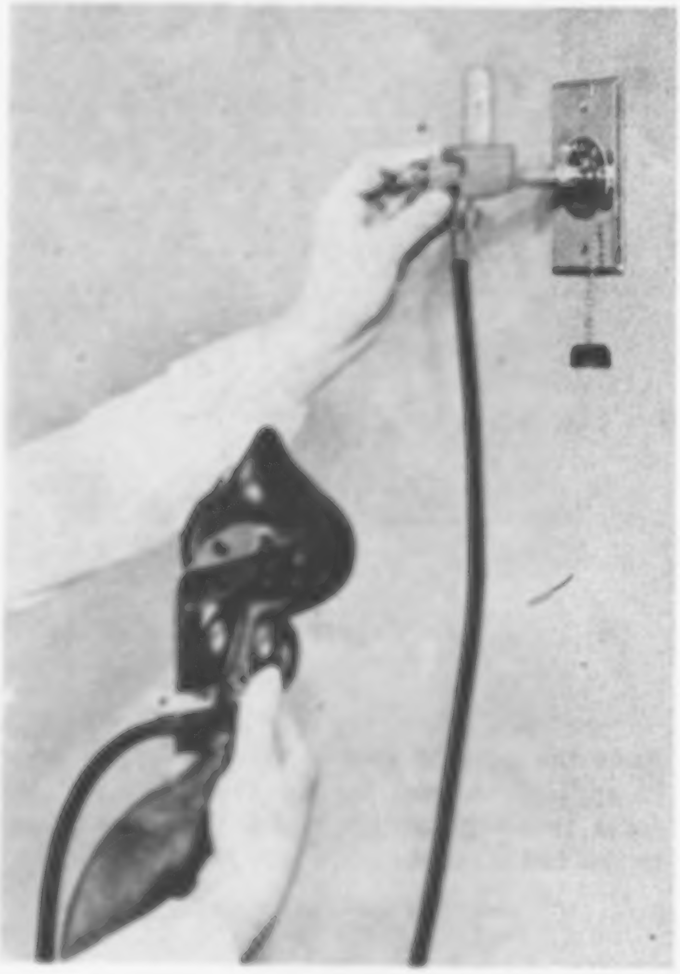
Choose a mask of the correct size. There are two sizes each, of the nasal and oronasal type (small or large). If the patient is unconscious, uncooperative, or a mouth breather, use the oronasal type facepiece.



Courtesy Linde Co.

Figure 20

Leave the hose connection and nut on the flowmeter outlet. Attach rubber tubing from the partial-rebreathing mask to the outlet of the flowmeter.



Courtesy Linde Co.

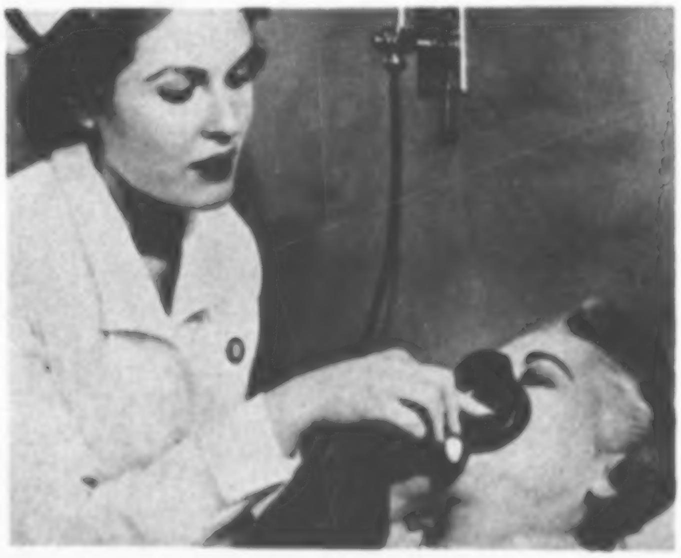
Figure 21

Set oxygen flow at 6 to 8 liters per minute. If the patient is large or is breathing heavily, 10 to 12 liters may be necessary at first to keep the bag from collapsing. Otherwise the patient may have difficulty in completing his first few inhalations.

It is important to overcome fear before a mask is applied. This can be done by letting the patient put the mask on himself or by letting him breathe a few times with it and then a few times without it.

After the mask is in place, the oxygen should be started at a high rate so as to give the victim an ample amount to overcome the acute need for oxygen in the blood.

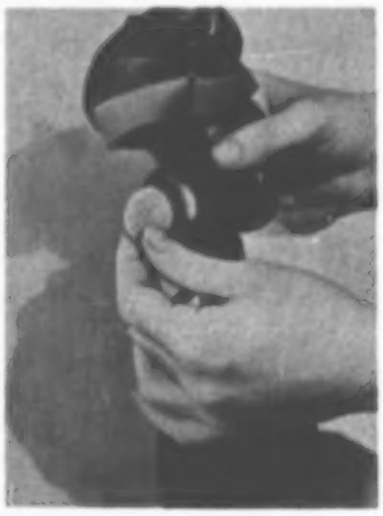
When a victim is inhaling oxygen, the breathing bag should never completely collapse. If it does, the amount of oxygen flow should be increased.



Courtesy Linde Co.

Figure 22

Have the patient exhale into the mask as it is applied. Adjust the headband so that the mask is snug but not tight. Clip the tubing to the bed clothes.

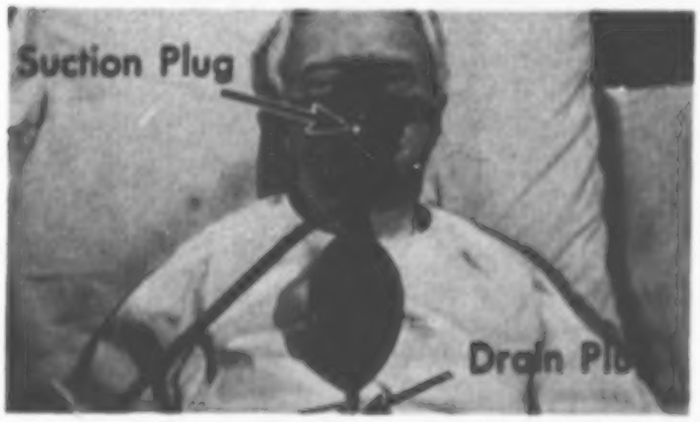


Courtesy Linde Co.

Figure 23

The sponge rubber disks at either side of the facepiece act as inhalation as well as exhalation valves. If these disks become moist or obstructed, air will not move freely through them and the mask will not function properly. The patient will usually complain of increased resistance to breathing. When this happens, remove the sponge rubber disks and replace them with dry ones. Or, rinse them thoroughly, squeeze them dry in a towel, and reinsert them.

Figure 23 shows how to remove and replace the sponge rubber disks if they become moist or obstructed. Figure 24 shows where to attach a suction tube and where to drain off accumulated moisture.

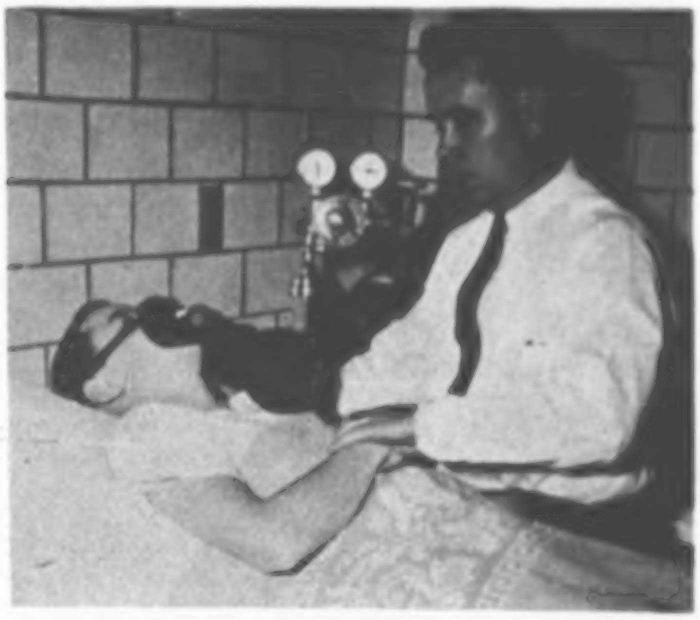


Courtesy Linde Co.

Figure 24

A partial-rebreathing mask usually has two plugs. One in the facepiece permits the use of a suction tube and the other, at the bottom of the breathing bag, allows drainage of accumulated moisture. Except for the purposes mentioned, these plugs must not be removed unless the mask is being washed.

A victim who is receiving oxygen by mask must be attended constantly (Figure 25).

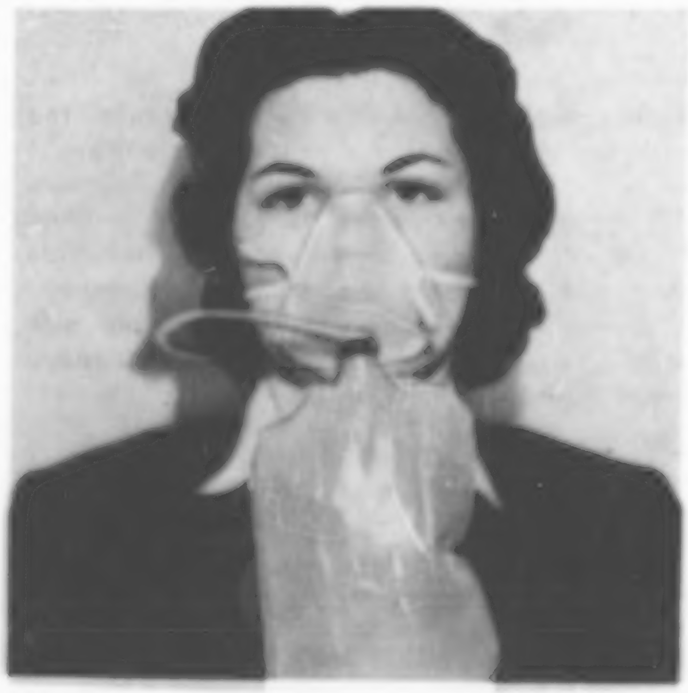


Courtesy St. Anthony Hosp.

Figure 25

A squadman watches to see that the victim breathes freely and that the breathing bag does not collapse completely during inhalation.

Disposable Masks - Disposable face masks, such as that shown in Figure 26, are now available. There are partial-rebreathing and non-rebreathing types that operate in the same way as similar permanent masks. There are also face pieces without any rebreathing features. In all cases follow the manufacturer's instructions. These light-weight plastic masks can be discarded after each use. Therefore, the time ordinarily required for cleaning and sterilizing is saved.

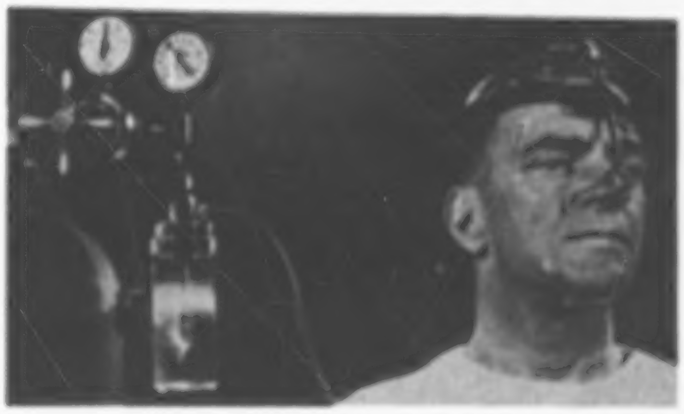


Courtesy Linde Co.

Figure 26

One of the many types of disposable masks now available.

Nasal Cannulas - These are pronged metal or plastic tubes, the ends of which are inserted a short distance into the nostrils (Figure 27). Oxygen should be administered by this method only when the other methods described herein are not deemed advisable. The concentration of oxygen possible by this method is relatively low.

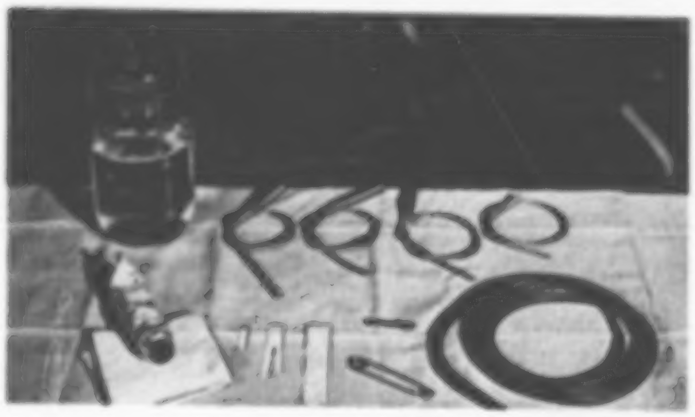


Courtesy Linde Co.

Figure 27

Metal nasal inhaler with adjustable headband for self-administration.

Nasal Catheters - The equipment needed for giving oxygen by nasal catheter is shown in Figure 28.



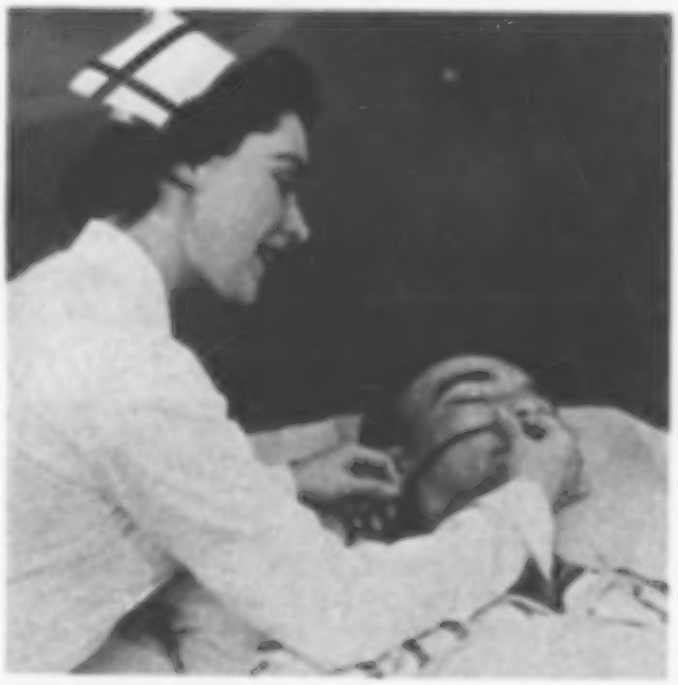
Courtesy Linde Co.

Figure 28

Set-up for deep catheter technique. (Glass of water, flashlight, and tongue depressor not shown.)

The two methods of nasal catheter administration are the shallow and the deep techniques. The shallow method (nasal catheter inserted just inside the nostril) is seldom used by squads.

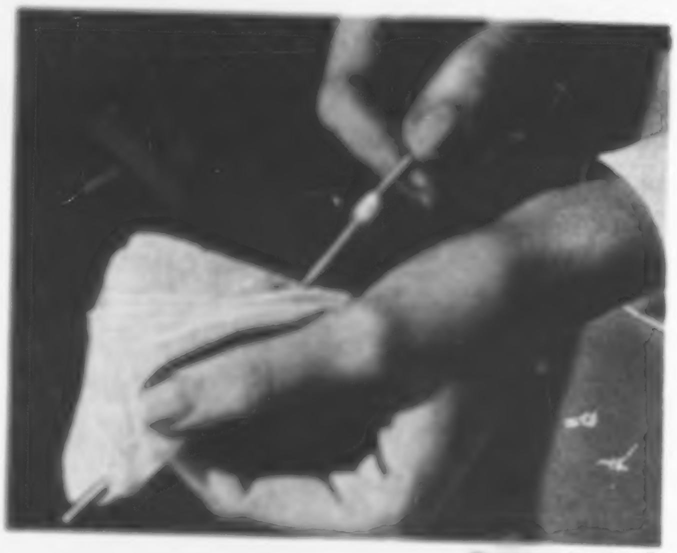
Figures 29 through 35 with their captions show and describe the techniques of inserting a deep nasal oxygen catheter.



Courtesy Linde Co.

Figure 29

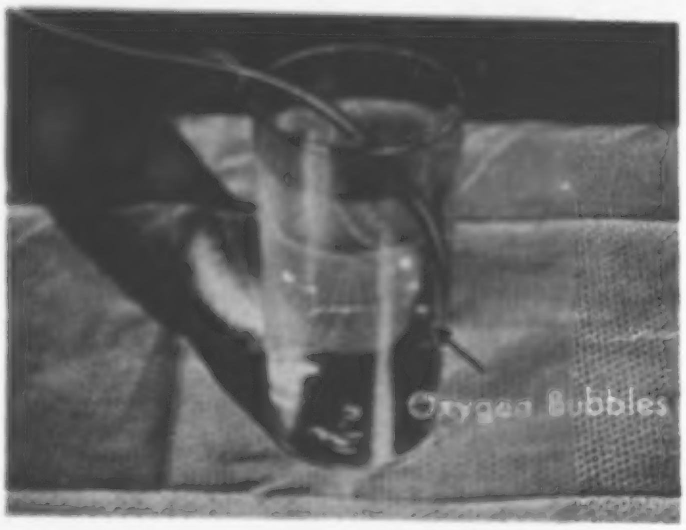
Determine the approximate depth to which the catheter will be inserted by measuring the distance from the tip of the nose (external nares) to the ear lobe (tragus). Mark this point on the catheter with a small piece of tape.



Courtesy Linde Co.

Figure 30

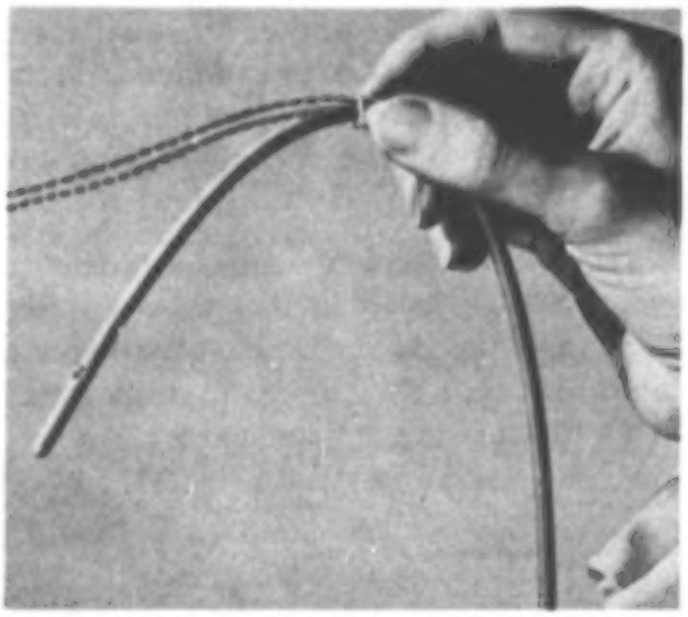
While oxygen is flowing, lubricate the catheter sparingly. Latex catheters should be lubricated with a water-soluble lubricant. Oil or fatty substances should not be used since these are a safety hazard. Also they may cause latex rubber to deteriorate. A water-soluble lubricant can be used with plastic catheters, although they are sometimes lubricated with water alone.



Courtesy Linde Co.

Figure 31

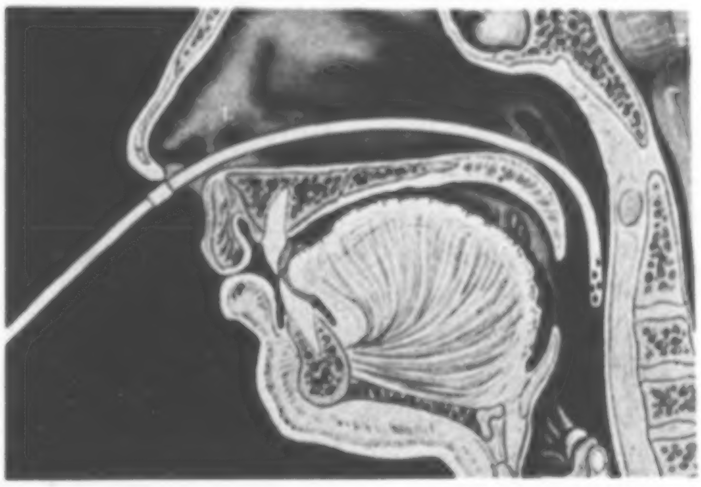
Hold the tip of the catheter in a glass of water, to be sure that the discharge holes are not plugged with lubricant.



Courtesy Linde Co.

Figure 32

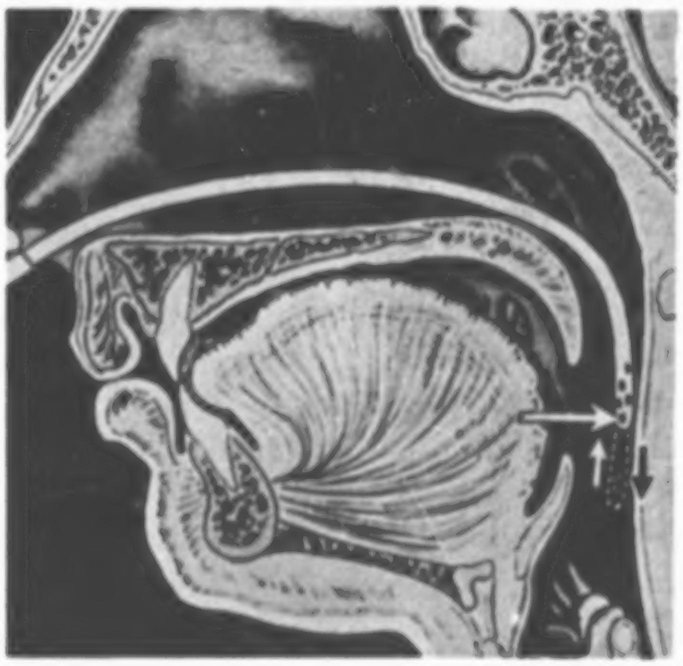
Determine the direction of the natural droop of the catheter by holding the taped part with thumb and forefinger and then slowly rotating it until its tip hangs at the lowest level.



Courtesy Linde Co.

Figure 33

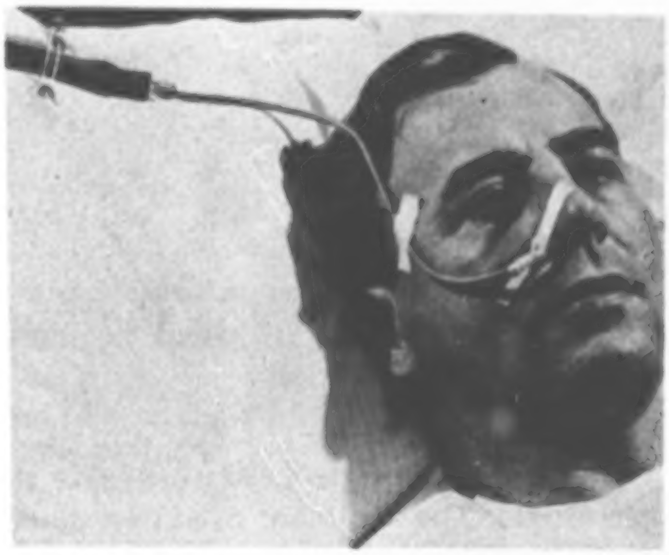
Hold the catheter in the position of its greatest droop, then WITH OXYGEN FLOWING, insert it slowly to the measured depth. It is easier to insert the catheter if you elevate the tip of the patient's nose. Observe the position of the catheter through the patient's open mouth. The tip should rest approximately opposite the uvula. Set the liter flow to deliver the desired concentration.



Courtesy Linde Co.

Figure 34

To assure that the catheter is in the correct position, insert it beyond the measured depth until the patient swallows oxygen; then withdraw it to a point where swallowing stops. This procedure can be followed only when the patient is conscious.



Courtesy Linde Co.

Figure 35

Tape the catheter firmly at the end of the nose; then bring it across the cheek and tape it to the temple. Be sure to tape it so that it lies on the inner 'floor' of the nose and cannot loop up inside, causing discomfort to the patient.

MAINTENANCE OF EQUIPMENT

Masks - Soak all parts in a detergent-disinfectant solution for twenty minutes. Then rinse thoroughly and dry.

Catheters - Rubber catheters should be washed thoroughly, with care given to the holes on the tip. These should not be obstructed. Catheters can then be left for twenty minutes in detergent-disinfectant solution. After twenty minutes, rinse and dry. Wrap them in clean materials to be ready for later use.

The preferred catheter for squads is the plastic disposable type. Since it is used only once, the cleaning problem is eliminated. It is also inexpensive.

Hospital emergency-room personnel are very co-operative in that they will often exchange a clean rubber nasal catheter for a soiled one. They have the proper facilities to sterilize rubber goods.

Nasal Prongs - The same care should be given to these as to a face mask.

SAFE PRACTICES

For safety, never use oil or grease on or in a cylinder valve, oxygen regulator or any oxygen connection.

All tanks should be held secure in the apparatus. The constant motion of the squad vehicle during calls will cause a dangerous situation if oxygen tanks are not held in place by straps, tank wells, blocks, or some other type of fixtures.

Smoking should be prohibited during the entire time oxygen is being administered. Oxygen does not burn, but it supports combustion.

The cushion of the face mask should be inflated at all times.

The resuscitator control valve should be set in the resuscitation position at all times when not in use.

All oxygen tanks must have a pressure test (hydrostatic test) at least once every five years. All tested tanks have the date stamped into them. Oxygen distributors will test tanks at a minimal cost.

Many squads fill smaller tanks from larger tanks. These smaller tanks must have the hydrostatic tests within a five-year period.

MASS OXYGEN THERAPY

In a special emergency oxygen in substantial quantities may be required, to care for large numbers of victims. It is not expected that local hospitals or squads will have on hand enough oxygen-therapy equipment or oxygen to take care of such an emergency. Therefore, supplemental equipment and oxygen will be required.

COMMERCIAL SOURCES

Oxygen is available from distributors of oxygen, oxygen-producing plants, industrial plants, welding shops, automobile repair shops, scrap yards, and oxygen-therapy rental services. See the yellow pages of your telephone directory under "Oxygen".

NOTE: Cylinders of oxygen obtained from the above sources may not be as clean outwardly as cylinders prepared especially for medical use, but their contents will be U. S. P. oxygen unless stated differently on the cylinder. Be sure that the word "oxygen" is on the cylinder. Cylinders of similar size, shape, and color might contain other gases that would be harmful.

Pressure-reducing regulators must be used on all high-pressure cylinders of oxygen. Hospital-type regulators and other oxygen-therapy equipment, such as tents, masks, and catheters, can be obtained from the manufacturers of such equipment and oxygen-therapy rental services. Regulators of the industrial type can be obtained from most of the places where oxygen is available. See the yellow pages of your telephone directory under "Oxygen".

NOTE: Industrial-type regulators differ from hospital-type regulators in that they do not have a restricted outlet and are calibrated in pounds per square inch instead of liters per minute. However, such regulators can be used in an emergency by opening the control valve very slightly, or by attaching a liter-flow adapter to the regular outlet. Liter-flow adapters can be obtained from suppliers of hospital regulators.

IMPROVISED EQUIPMENT

1. Oxygen can be administered by inserting a piece of tubing or welding hose through the bottom of an ordinary paper bag and holding the top of the bag over the victim's face. Use a generous flow of oxygen.
2. Make a cone of cardboard, old X-ray film, stiff paper, or similar material. Insert the oxygen hose through the bottom of the cone and hold the top over the victim's face.
3. In a cardboard carton about twenty inches square, cut a hole about nine inches in diameter in the center of the bottom. Slide the victim's head through the hole. Insert the oxygen hose through the side of the carton opposite the victim's head. Leave the top of the carton open or cut the top off entirely.

EMERGENCY HELP

Persons familiar with oxygen and equipment can be located at any of the places where oxygen is available. These persons are not necessarily familiar with oxygen-therapy techniques but they should understand the mechanics of attaching a regulator to a cylinder.

CHAPTER XII

CLOSED-CHEST HEART COMPRESSION

INTRODUCTION

For years the physicians of our nation were coping with heart stoppage by opening the chest wall and actually massaging the heart by hand. This was done in all situations, even outside of hospitals.

Then a group of researchers found that applying pressure with the hands on the outside of the chest could create the same results. This led to a whole new technique for resuscitative procedures. It was a technique that did not necessarily need a physician on the spot to carry it out. A well trained emergency squad can carry out this new procedure until the patient can be brought to definitive care in a well equipped hospital emergency room.

Some persons are concerned about the possibility of causing injuries by this technique. Close investigation has shown that no damage to victims resulted when emergency personnel who applied this technique had received formal classroom instructions, including correct demonstrations.

An emergency squadman is usually the first trained person to reach the heart-stoppage victim, except in a hospital. It is imperative that each and every squadman be completely trained in this new technique.

The following text and series of pictures with captions deal with this life-saving procedure. However, studying the chapter is not sufficient. Each step must be practiced and carried out many times, so that all members of the squad are proficient in all maneuvers.

SYMPTOMS

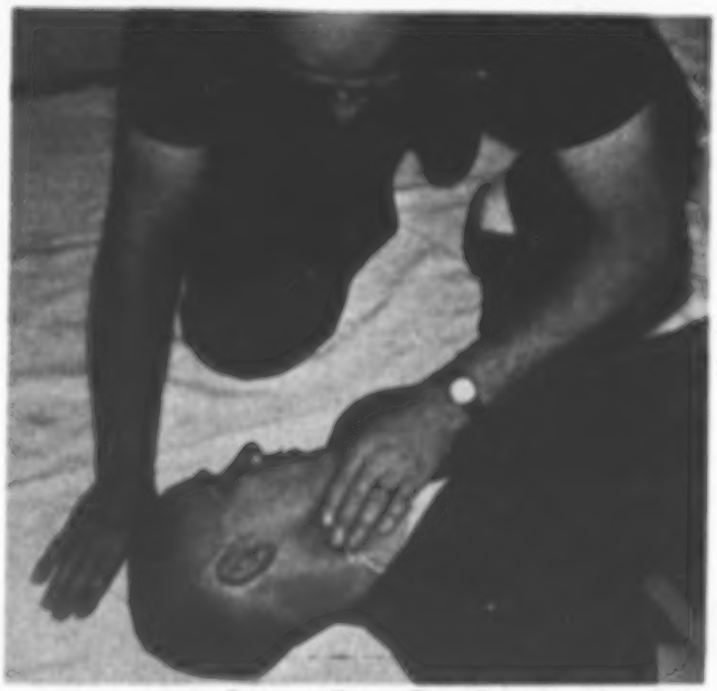
Upon arrival at an emergency scene, the squadman must be able to establish whether the victim is in need of closed-chest heart compression. The need can be established by the three following findings:

1. The victim is not breathing.
2. The victim does not have a carotid, or neck pulse.
3. The pupils of the victim's eyes do not react to light.

EXAMINATION

To determine whether the victim is breathing, place one hand over his abdomen in the area of the diaphragm (just below the chest.) If there is no motion, no air is being exchanged.

To establish whether a neck pulse is present, place the four fingers of one hand between the large muscle at the side of the neck and the windpipe. (See Figure 1.) If the heart is not beating, there will not be a pulse.



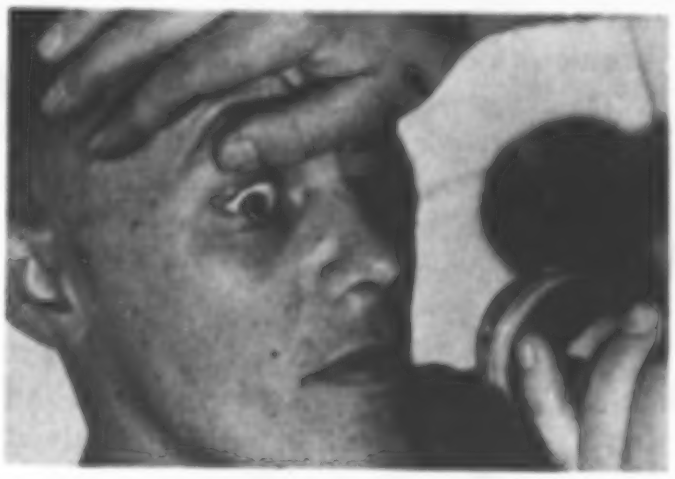
Courtesy Sharon Twp. F.D., Worthington, O.

Figure 1

Examining for a neck pulse.

The pupils of the eyes usually constrict (get smaller) if a light is directed on them. This is normal. If the heart is not beating, the pupils will not react to light: they will be dilated (enlarged) and stay dilated.

To examine the pupil, raise the eyelid quickly and direct the light of a flashlight, for a few seconds, at the pupil. If the pupil does not react, closed-chest heart compression is indicated. (See Figure 2.)



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 2

Examining for pupil action.

With these three symptoms present, the victim must be given closed-chest heart compression immediately.

PROCEDURE

For this technique to be successful, the victim must be on a firm or hard surface. If he is left on a soft surface, the rescuer will be pushing the victim into this soft surface and not compressing the heart. Lay the victim on a floor or any other hard surface. While he is in transport, place him on a backboard especially if there is a mattress on the squad stretcher.. It may even be necessary to place the victim on a board and then place the board on the floor of the squad vehicle, to be able to give successful closed-chest heart compression.

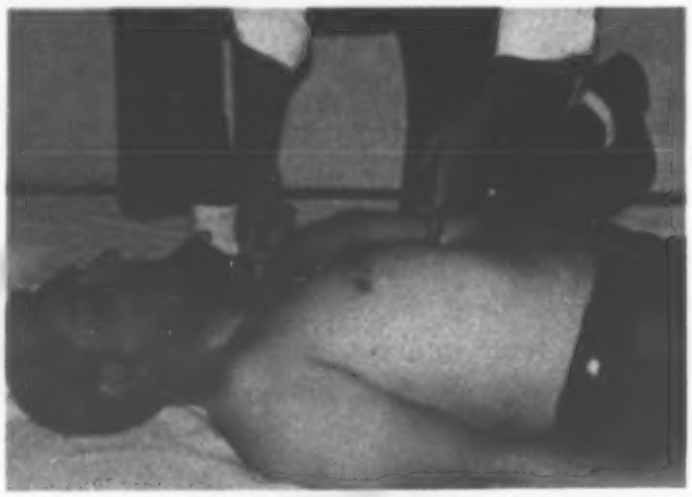
Mouth-to-mouth resuscitation and closed-chest heart compression must be given together. As soon as it is found that closed-chest heart compression must be given, four or five breaths of mouth-to-mouth resuscitation should be administered.

If two rescuers are present, one can give the mouth-to-mouth while the second measures the chest. If only one is present, the initial mouth-to-mouth breathing must be performed first. Then the squadman proceeds to measure the victim's chest region.

LOCATING THE HEART

The heart lies directly under the sternum or "chest bone".* Pressure on this bone will compress the heart and force the blood out of it. Relieving the pressure will allow the heart to refill.

To locate the region where pressure is to be applied, place a finger of one hand, (preferably the index finger) at the top of the chest bone and a finger (index) of the other hand at the bottom. (See Figure 3.) The lower half of the chest bone is the exact area wanted.



Courtesy Sharon Twp. F.D., Worthington, O.

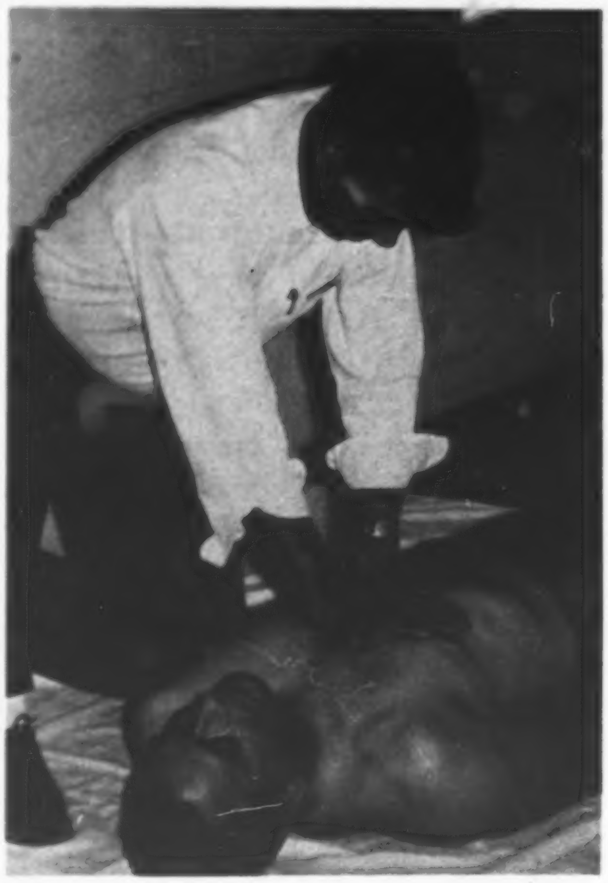
Figure 3

Measuring the sternum, or chest bone.

PLACING THE HANDS

Kneel beside the victim. Place the butt or heel of one hand on the lower half of his chest bone. (See Figure 4.) The butt of your hand should lie along his chest bone, with fingers extending toward his ribs.

Place the second hand over the first. The direction of the second hand is whichever is comfortable to the rescuer.



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 4

Placing the hands

APPLYING THE PRESSURE

With hands on the victim's chest bone, straighten your arms until the elbows hurt. Bend forward until your shoulders are directly over your hands. Now begin to apply pressure: Push directly down until the chest bone moves 1½ to 2 inches. (See Figure 4.)

---

* Although squadmen commonly call it the "chest bone", in medical terminology it is the sternum or breastbone.

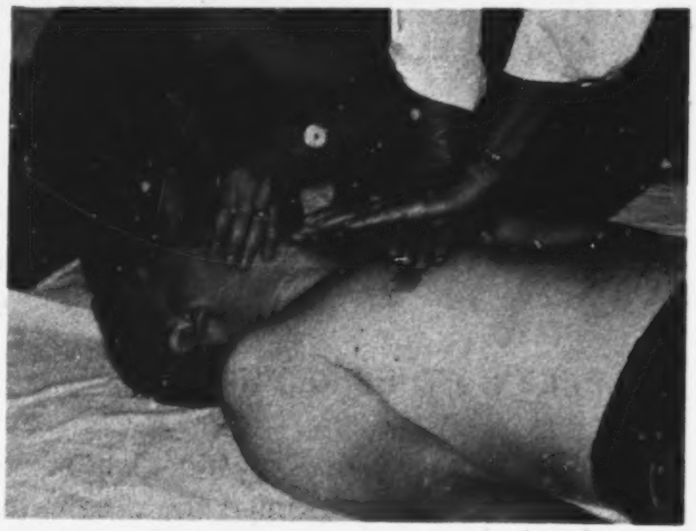
Hold your fingers up off the victim's chest. This will help to keep your hands in the proper place.

The rate is 60 compressions per minute. Practice this procedure alone, and also with another rescuer, until you are sure of maintaining your rate at 60 times per minute.

If the rate is too slow, not enough blood will be pumped out of the heart to sustain the victim's life. If the rate is too fast, the heart will not fill properly. Each squadman should develop a technique that will sustain the right rhythm and rate.

METHOD FOR TWO RESCUERS

There is a definite ratio that must be maintained between heart compressions and lung inflations. For two squadmen working together it is five closed-chest heart compressions and one mouth-to-mouth inflation. As one rescuer's hands are coming up at the end of the fifth compression, the second rescuer should be inflating the victim's lungs. The chest will rise as the hands come up. Close cooperation will maintain a rhythm and will also save time. (See Figure 5.) If the two rescuers tire, they can change positions.



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 5

Two rescuers working together. The rhythm is five closed-chest heart compressions and one mouth-to-mouth resuscitation.

METHOD FOR ONE RESCUER

One squadman working alone should maintain a ratio of 15 chest compressions followed by two mouth-to-mouth resuscitation breaths. When working alone, the squadman cannot take time to place his thumb in the victim's mouth, to extend the chin and head. Air should be given as shown in Figure 6.

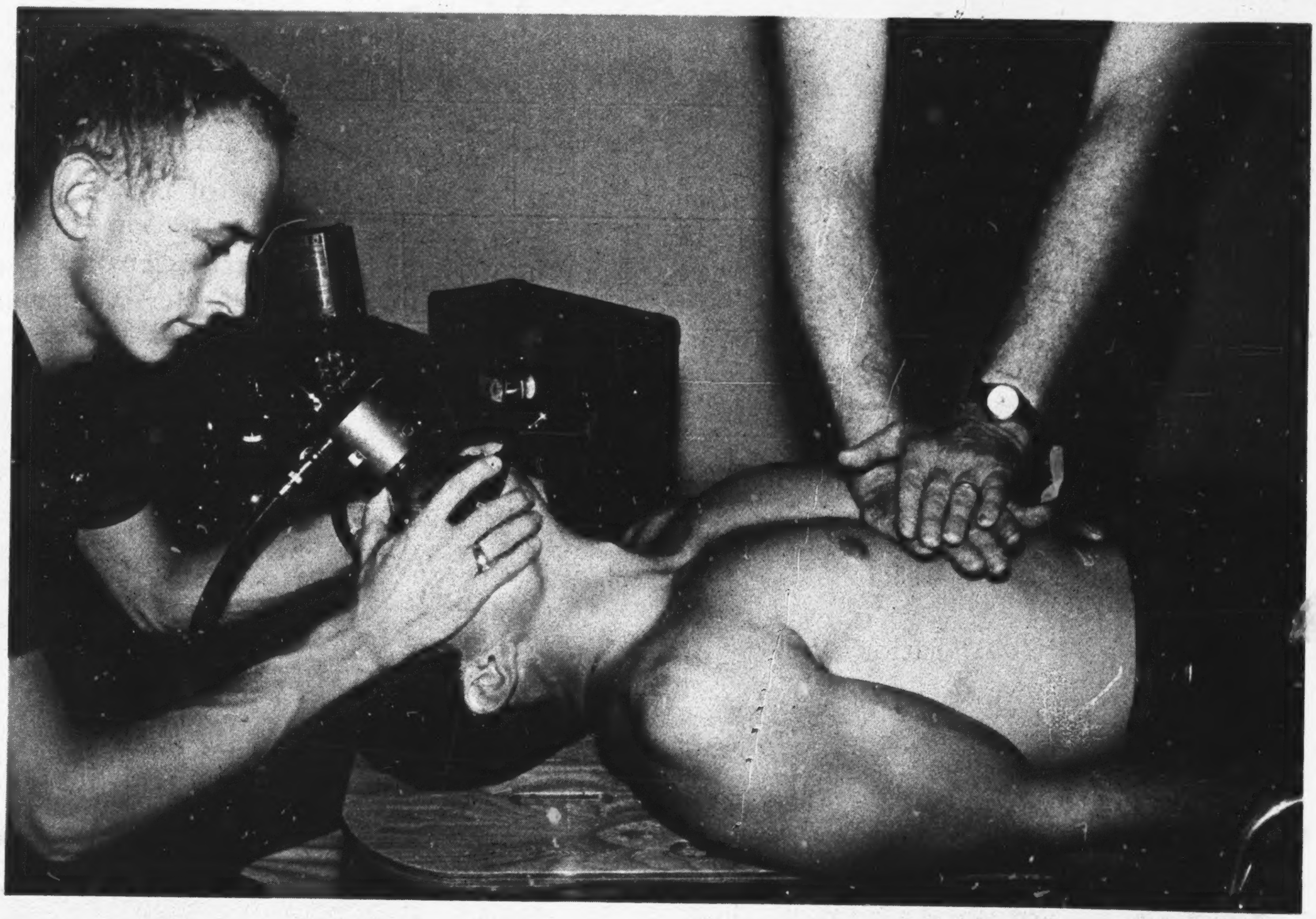
Courtesy Sharon Twp. F.D., Worthington, O.

Figure 6

One rescuer working alone. With one hand under the victim's neck, he supports the head in proper position for mouth-to-mouth breathing.

USE OF THE RESUSCITATOR

If a mechanical resuscitator is available, it should be put into play as soon as possible. In this procedure the rescuers give ten closed-chest heart compressions and then one inflation with the resuscitator. Hold the mask as described in Chapter X of this text. Put it on the face but not airtight. At the tenth compression push on the mask to make it airtight and it will inflate the lungs. The 10 - 1 ratio can be continued even during transport. (See Figure 7.)



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 7

Use of the resuscitator during closed-chest heart compression.

MANUAL OVER-RIDES

Mechanical resuscitators that incorporate the negative and positive pressure manual over-rides can be used to assist in ventilation of the victim's lungs in conjunction with closed-chest heart compression.

This manual over-ride feature permits the operation to manually resuscitate with pressures higher than the normal, but not high enough to injure the victim's lungs.

Other resuscitation devices can be used, such as the mouth-to-mask resuscitator (Figure 10) or bag-mask resuscitator.

CARTILAGE SEPARATION

In older persons (60 and older) there may be a separation of the cartilage between the ribs and the chest bone due to the pressure of closed-chest heart compression. This is not unusual and is not considered a complication.

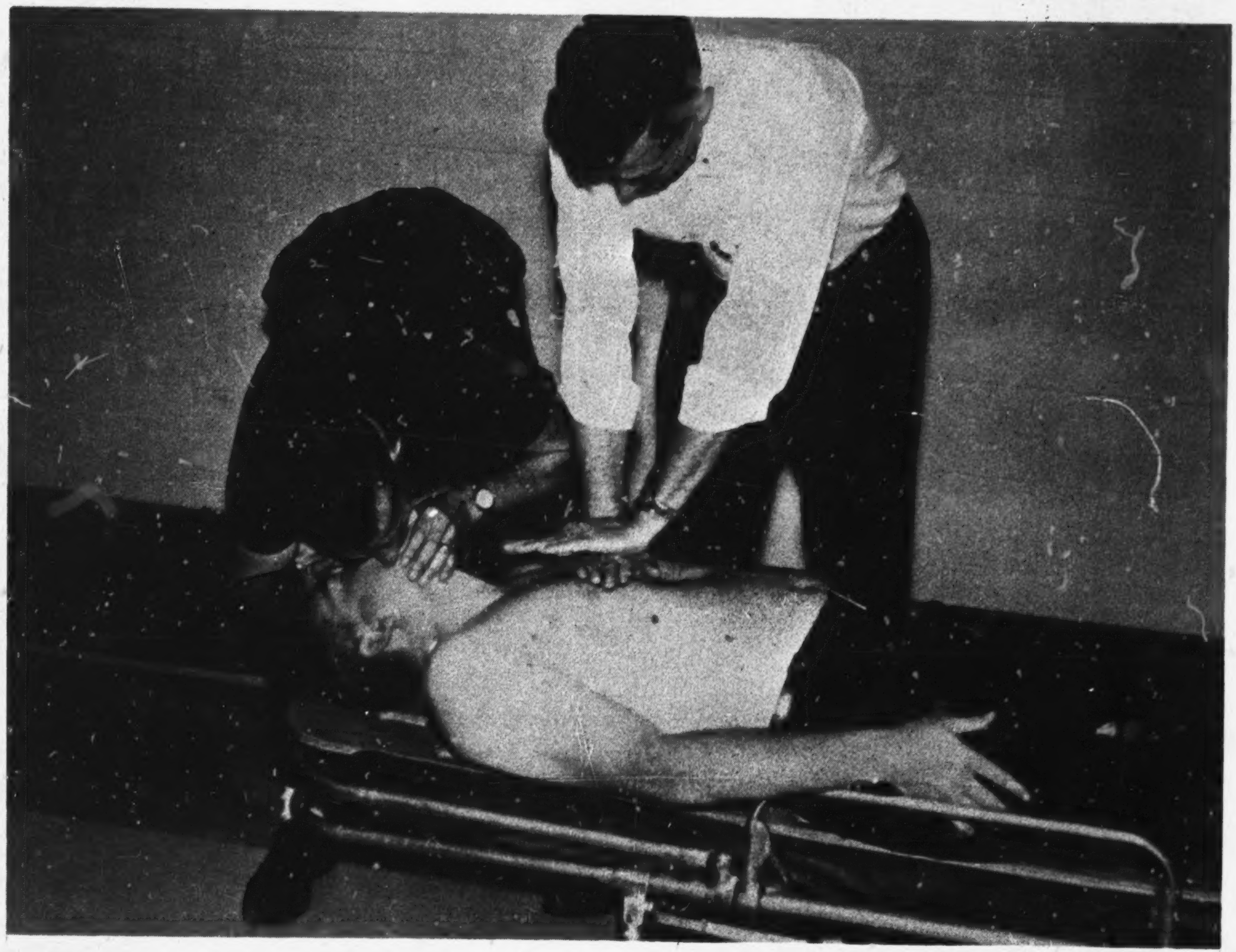
CHILD VICTIMS

This technique is the same for children, except that the use of one hand on a child's breastbone, or two fingers for an infant, is adequate. The compression rate for children should be 80 to 100 times per minute.

TRANSPORTATION

With the victim on a backboard, closed-chest heart compression and resuscitation can be carried out and continued while loading into the squad vehicle, and while en route to the hospital. (See Figures 8 through 11.)

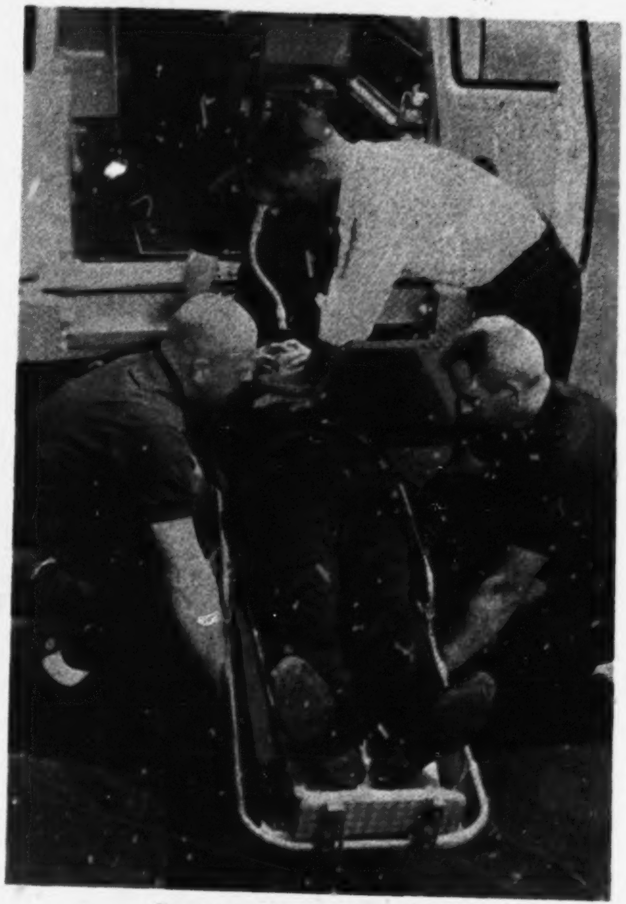
The hospital to which the squad is en route should be notified of the patient's pending arrival. This will allow time for the emergency room team to prepare equipment and drugs before the victim arrives.



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 8

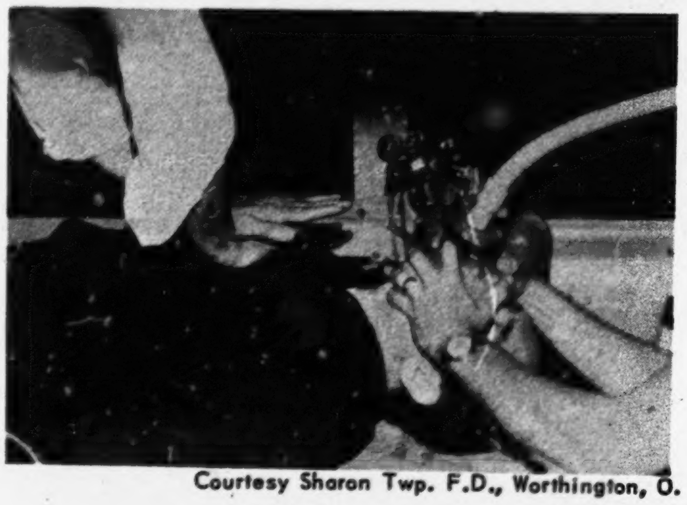
With the victim on a backboard, both life-saving procedures can still be carried out.



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 9

Loading the victim into squad ambulance.



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 10

Both procedures being continued in the squad ambulance.

CONCLUSION

This newest resuscitation procedure can not be learned just by reading material in a text. Continual practice and experience are necessary. The procedure should be reviewed often.

CHAPTER XIII

USE OF BACKBOARDS

INTRODUCTION

The backboard is a versatile tool. Its primary purpose is the immobilization of fractures of the neck and back. But this rigid board is also ideal for moving victims of other conditions such as fractures of the pelvis or both legs.

To carry a large unconscious patient down three flights of stairs is a real job. Strapping the patient securely to a backboard makes the job much easier.

After using the backboard for a short time, squadmen will recognize many other types of situations in which it is useful.

Victims should be moved onto a backboard by the method known as "logrolling".

LOGROLLING

DEFINITION

Logrolling is the turning of a victim's body by several people working in unison. Its purpose is to protect a victim who must be moved onto (or off of) a backboard or stretcher, when his back or neck may be injured.

The procedure has been used for many years in hospitals. It should always be used by squadmen on accident victims with suspected neck and back injuries.

Logrolling is also a wise practice whenever squadmen are preparing to transport an unconscious victim.

Figures 1 through 12 and their captions show logrolling procedures. The position of the squadman's hands should always be, as nearly as possible, that shown in the pictures. When a victim is to be removed from a car or truck, these same hand positions can be used.

PREPARING TO ROLL

Emergency care should be given to the victim before he is logrolled.

After emergency care, when you are ready to move the victim onto a backboard, establish on which side he is to be rolled: it should be his least injured or non-injured side. Next, raise the victim's arm, on the side onto which he is to be rolled, above his head. (See Figure 1.)

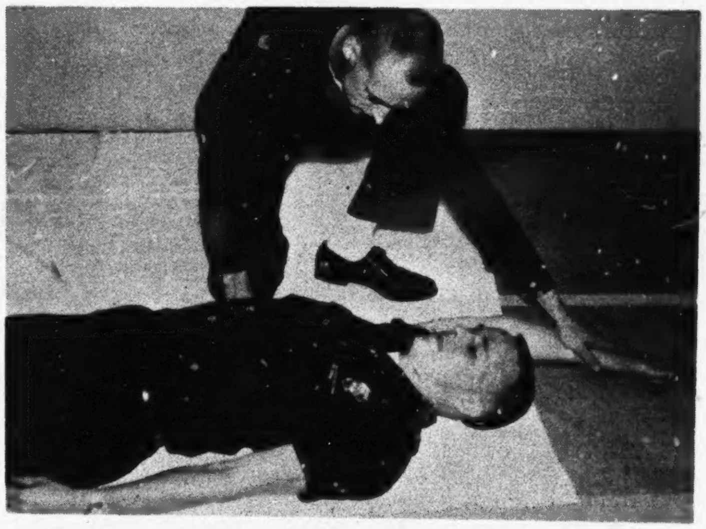


Figure 1

Raising the victim's arm prior to rolling. In this case he will be rolled onto his right side.

POSITION OF HANDS

The exact position of each squadman's hands on the victim is very important in logrolling.

1. The top man's top hand is to be under the neck, supporting the head. His bottom hand grasps the clothing (or skin) at the shoulder (See Figure 2.)
2. The center man's top hand is to be around the victim's distant arm and grasping the clothing. His bottom hand grasps the clothing at the belt region.
3. The bottom man's top hand grasps the victim at the hip region. His bottom hand grasps the distant leg at the calf.

ROLL

At a signal from the top man, all three roll the victim toward them. (See Figure 3.) Note that four of the six hands of the squadmen are grasping the trunk of the victim's body. Also note that the victim's head is supported by the top squadman. All squadmen should be on the same knee.

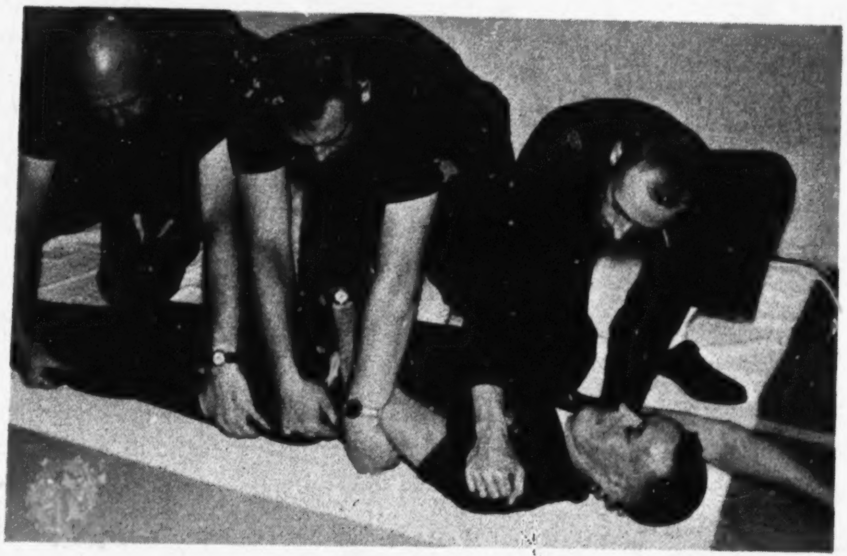


Figure 2

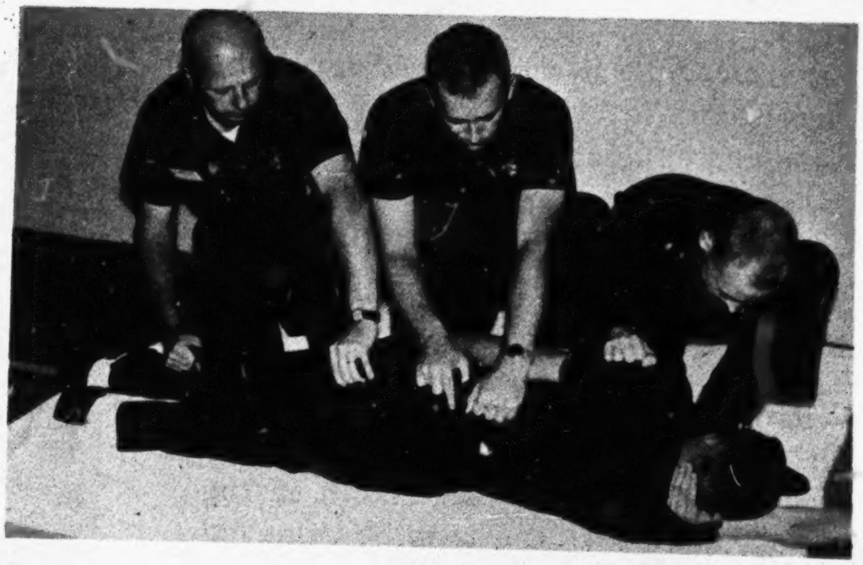


Figure 3

Figure 2 shows the location of each squadman's hands on the victim before logrolling. In Figure 3 the victim has been logrolled onto his side.

PLACING THE BOARD

While the victim is held on his side, the board is placed flat on the ground or floor next to the victim. (See Figure 4.)

Again on a signal from the top man, the victim is lowered on the board. His arm is returned to his side.

SLIDING THE VICTIM

The victim usually is centered when placed on the board. If he is not centered on the board, he can be slid over by the rescue team, working in unison. While the man who placed the board holds it, the other three squadmen remain where they were and place their hands on the victim's body, in the same positions, but on the opposite side. (See Figure 5.)

At the signal of the top man, the victim is slid over with a gentle, even motion.

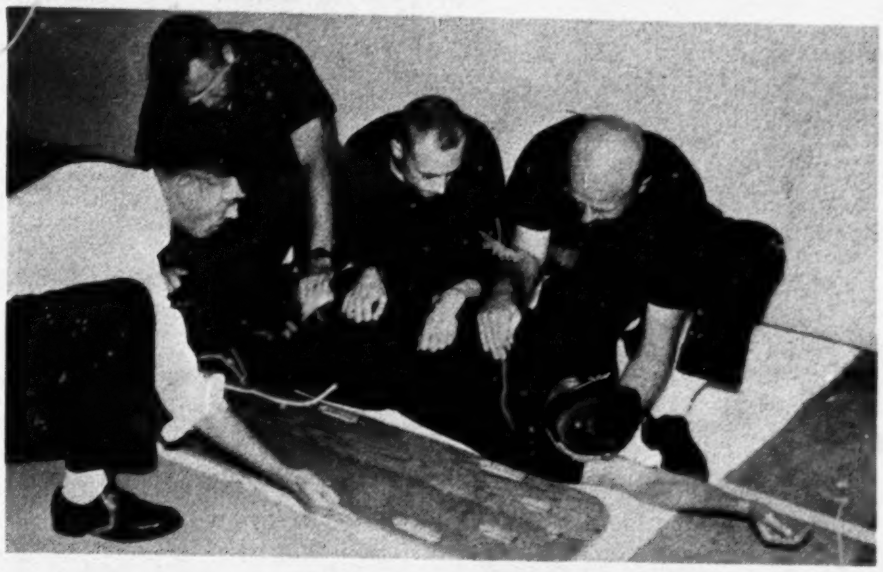


Figure 4

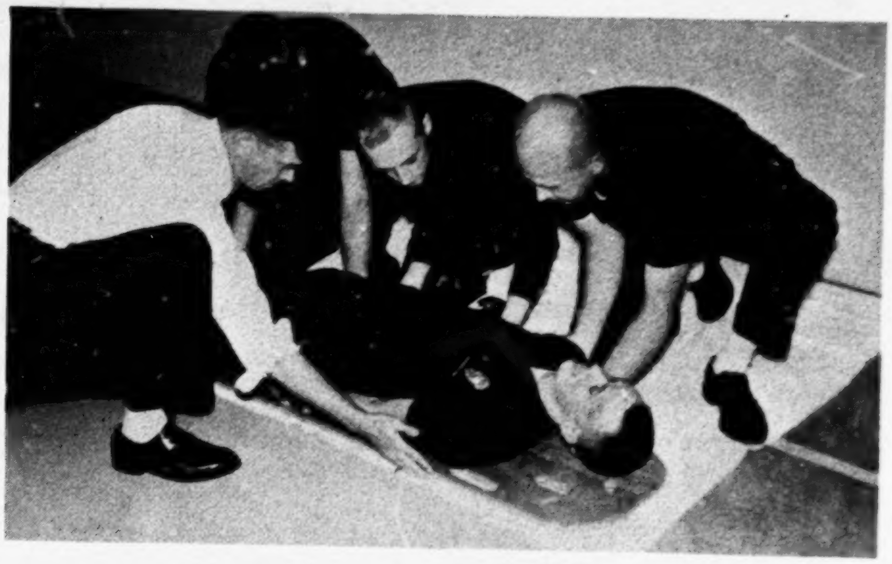


Figure 5

A backboard is placed behind the victim (Figure 4). After he is lowered onto the board he can be slid gently toward the center if necessary (Figure 5).

BOARD WITH FOOTREST

If it is determined a footrest will be needed on the backboard, insert it prior to logrolling the victim.

The squadman who will place the board should measure the board by placing the board and footrest as shown in Figure 6. The board is then placed on the floor and the victim is logrolled as previously described.

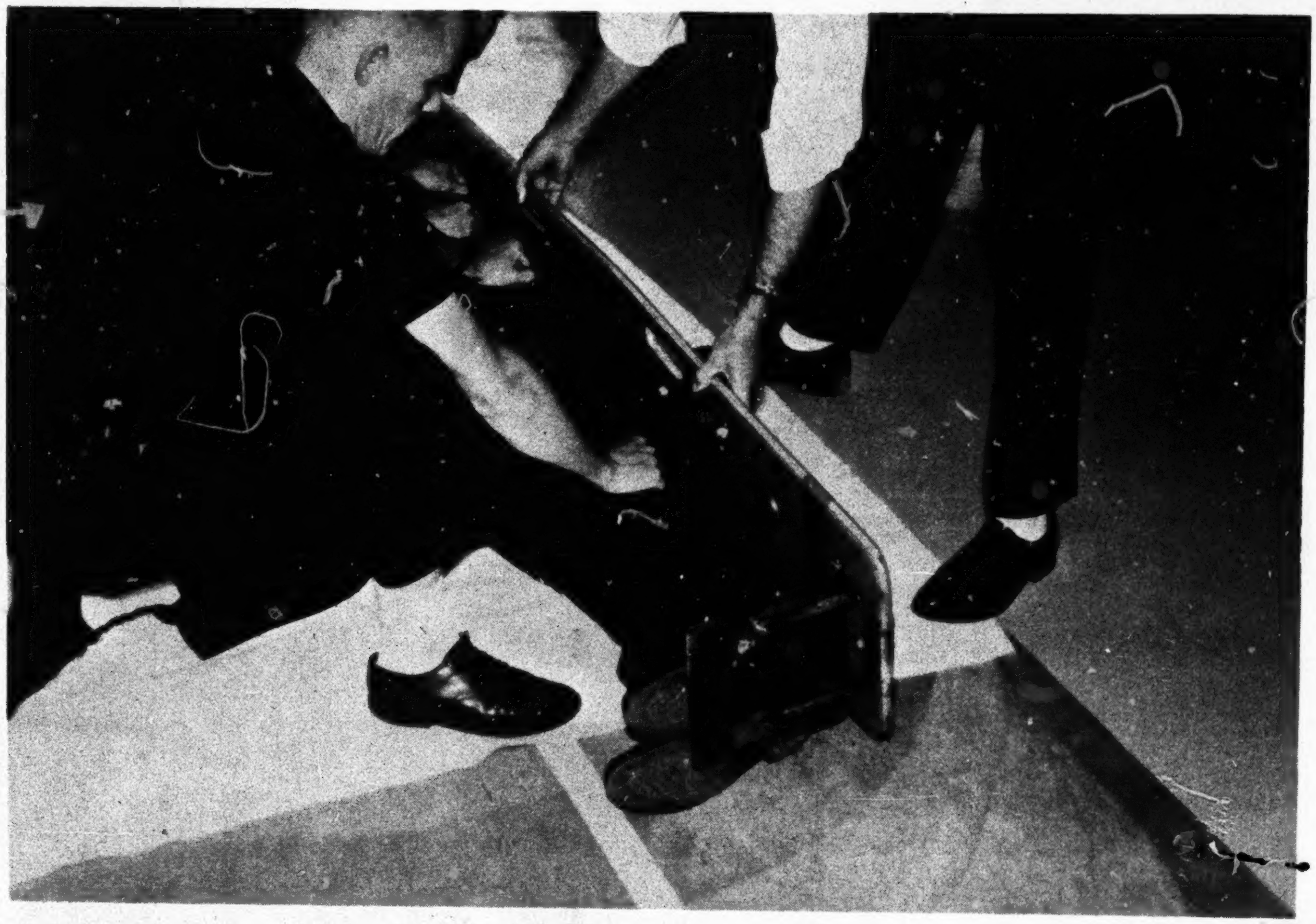


Figure 6

If a footrest will be needed, place it against the victim's feet with the backboard in place.

POSSIBLE NECK INJURY

If a neck injury is suspected, one squadman must attend the head and neck at all times until it is immobilized.

Figures 7 and 8 show the proper way to logroll a neck injury.

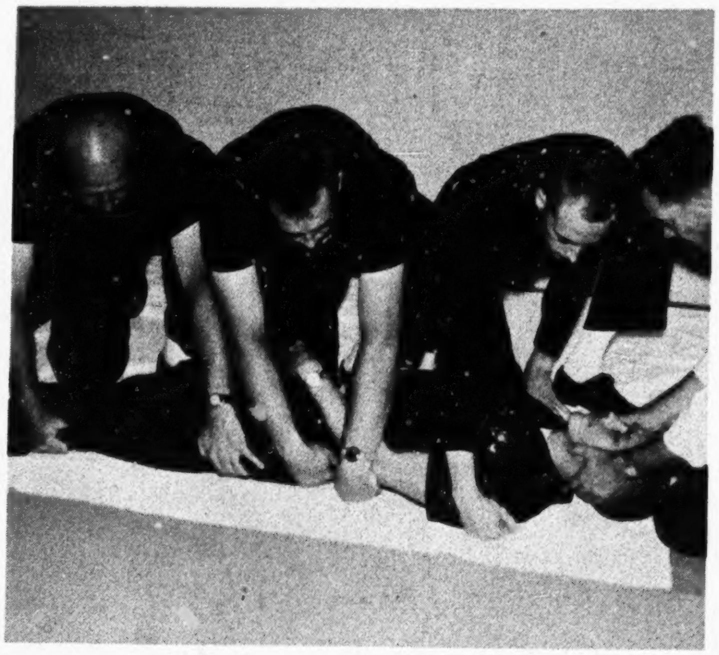


Figure 7

Note that the squadman caring for the neck is applying slight traction, supporting the chin and keeping the nose in line with the "belly button" at all times. Also note that the man at the shoulder uses only one hand during this procedure. The man caring for the neck should give all signals. The victim's neck should then be immobilized with a blanket-roll splint as shown in Chapter VIII.

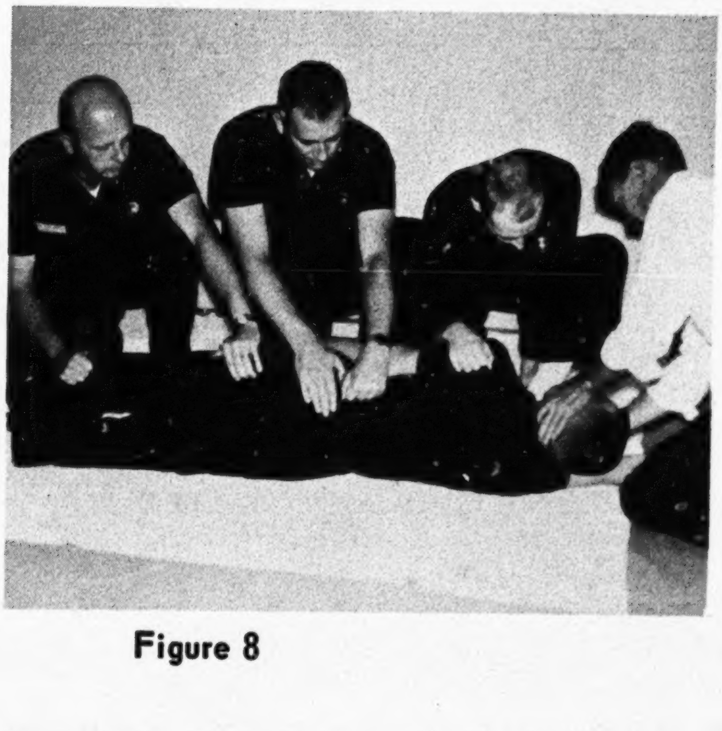


Figure 8

Four men logroll a suspected neck-injury victim.

ROLLING VICTIM FACE DOWN

When a victim is found face down and should be transported that way (severe bleeding at the face, secretions and mucus from the mouth, vomiting, etc.) the procedure is much the same.

Figure 9 shows the placement of the hands for this procedure.

Figure 10 shows the same victim on his side.

Figure 11 shows the placing of the board.

Figure 12 shows the victim, face down on the board.

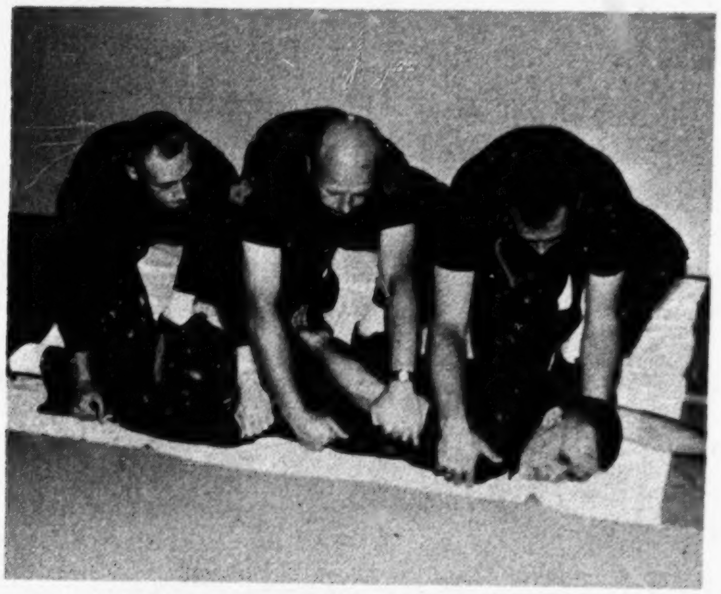


Figure 9

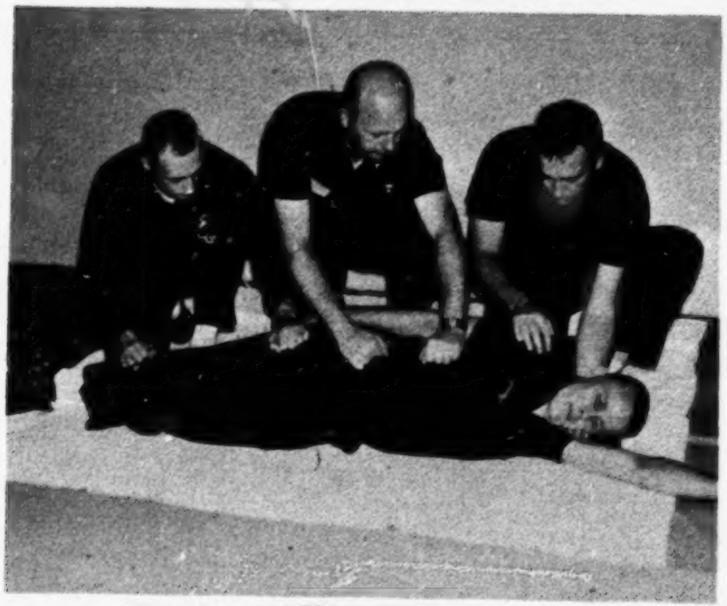


Figure 10

Squadmen's hands are placed for logrolling a victim face down (Figure 9). Then the victim is rolled onto his side (Figure 10).

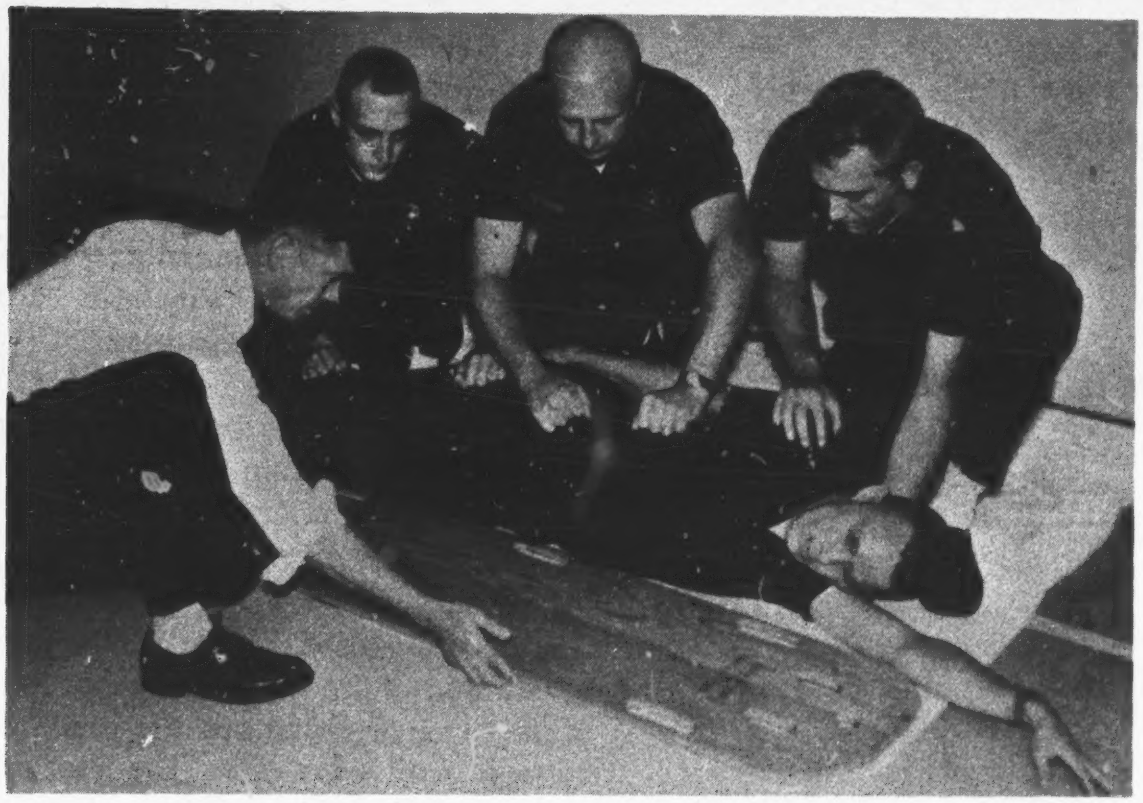


Figure 11

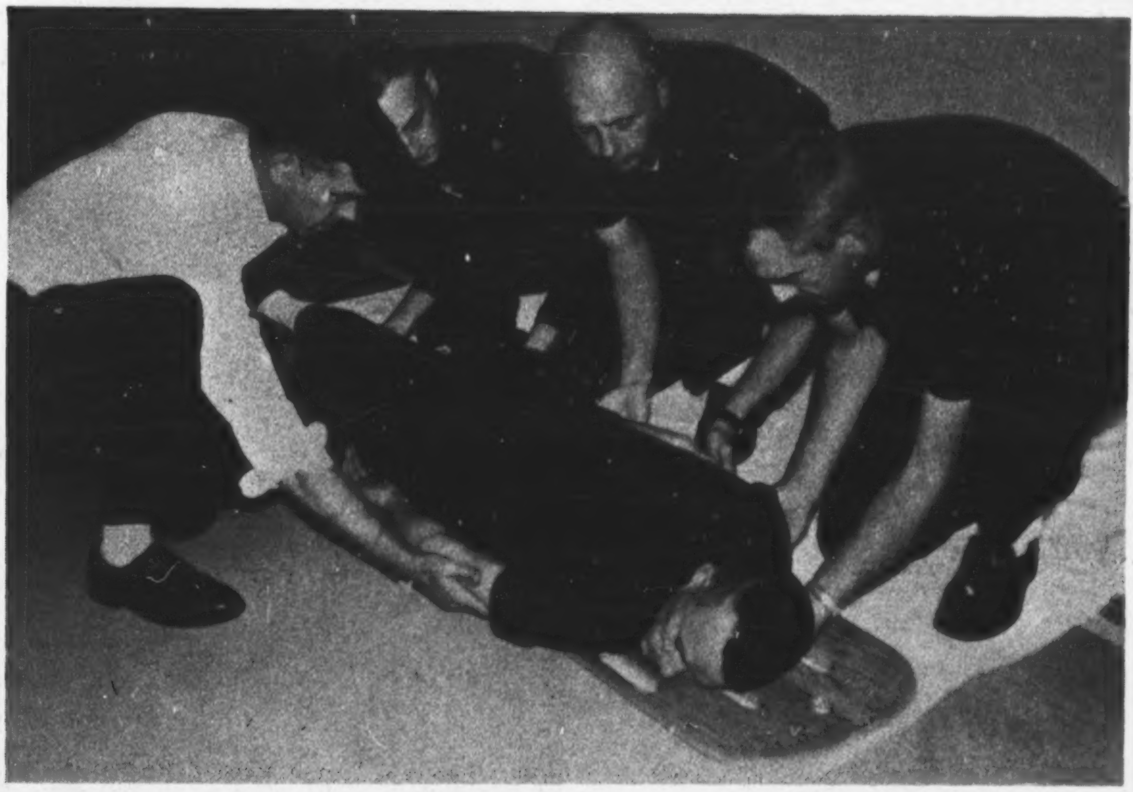


Figure 12

The board is placed in front of the victim (Figure 11). After he is lowered to a face-down position he can be slid gently to the center of the board (Figure 12).

HANDLING OF BACKBOARDS

The following series of pictures (Figures 13 through 20) illustrate how to use backboards.

Specifications for two backboards, child and adult sizes, can be found in Chapter II of this manual.

STRAPPING A VICTIM TO A BOARD

If a victim must be carried for some distance on a backboard, he should be strapped to it.

Placing Straps - The positions of the three straps on the victim are most important.

1. The bottom strap must be placed around the board and around the victim just above his knees. This will prevent him from raising his legs off the board.
2. The middle strap must be placed around the board, and across the victim's hip region. His hands should be at his sides; the strap passes over his wrists.
3. The top strap must be placed around the board and across the victim's chest region, just below the shoulders.

All three of these strap positions can be seen in Figure 13. Note the straps do not go through the holes in the board, but around the board. The straps would not be located properly if they were put through the board holes.

Securing Feet and Head - If the victim must be carried up or down any distance, a footrest must be put in place and his feet must be tied to it with a cravat. The victim's head can be kept secure with a cravat. Figure 14 shows how the cravats are tied.

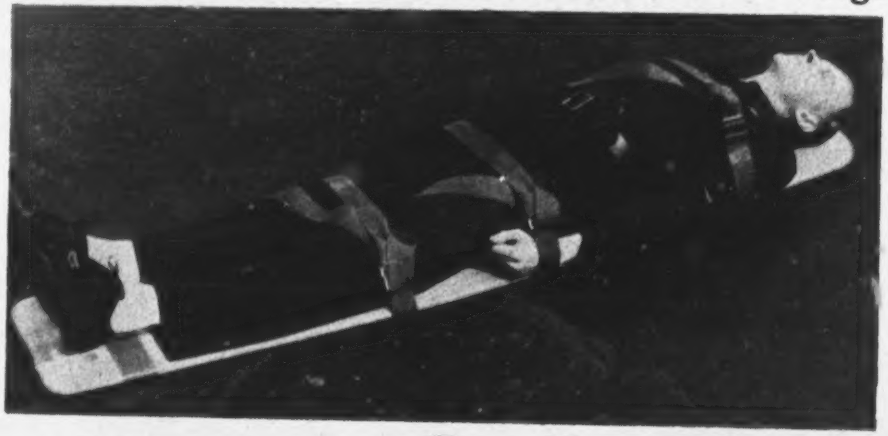


Figure 13

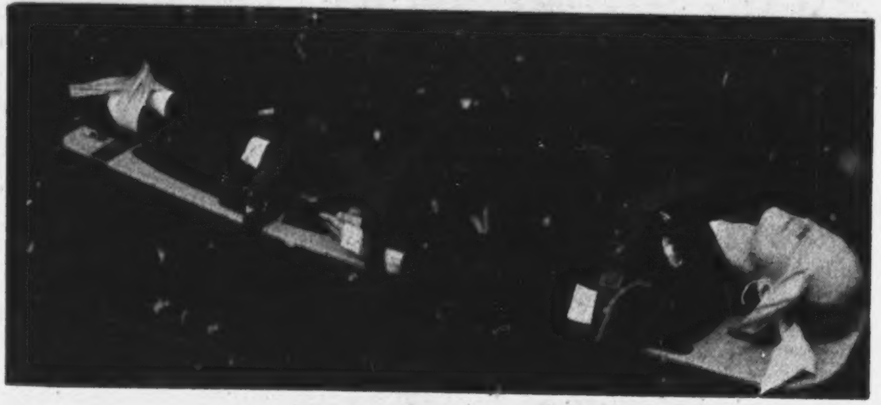


Figure 14

Figure 13 shows proper strap placement. The bottom strap passes just above the knees; the middle strap passes across the thighs and over the wrists; the top strap passes across the upper chest. Figure 14 shows proper placement of straps, footrest, and cravat bandages.

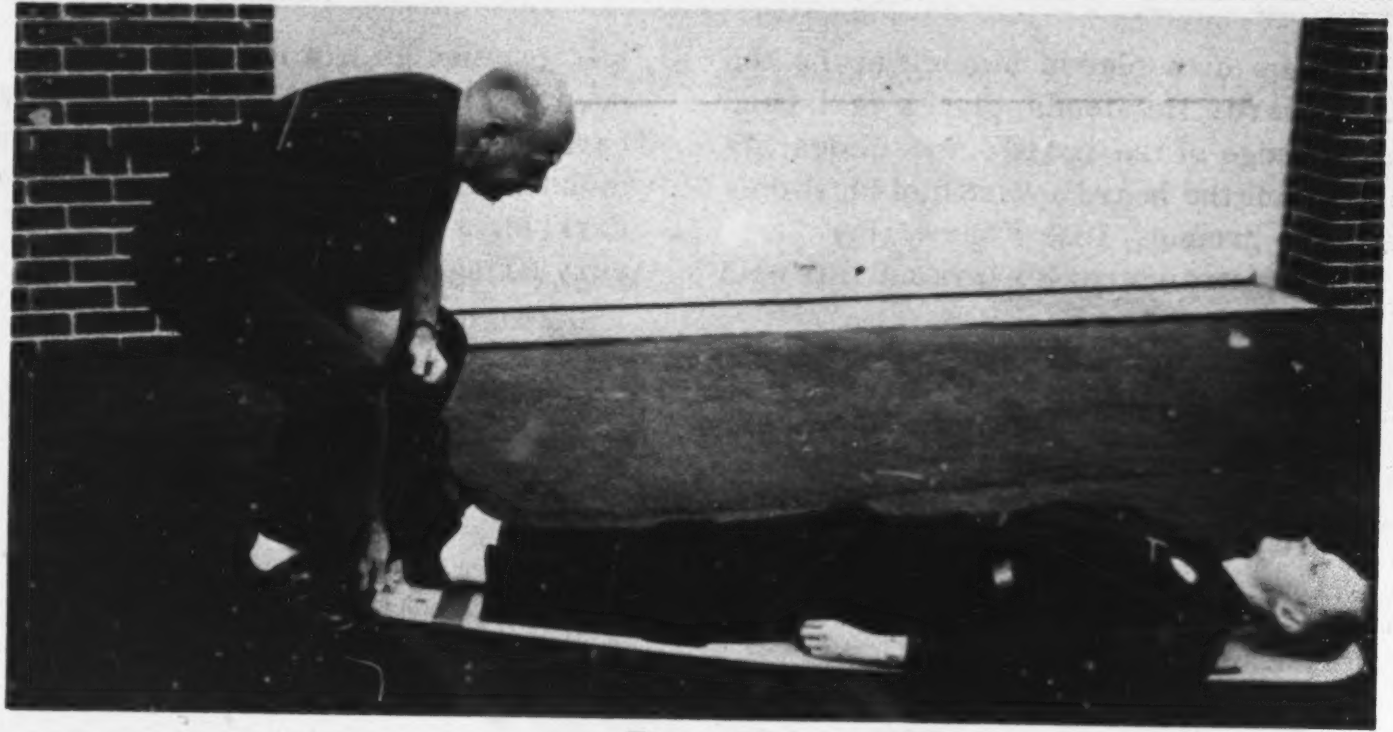


Figure 15

Squadman places one hand on board handhold.

RAISING THE BOARD

To raise a backboard, one squadman places four fingers of one hand into the handhold in the bottom of the board. (See Figure 15.) He then lifts the board and places it on one foot. (See Figure 16.)

Then he takes hold of the board with both hands, bends his knees, and lifts with his legs, not his back. He lifts the board just to his knees. (See Figure 17.)

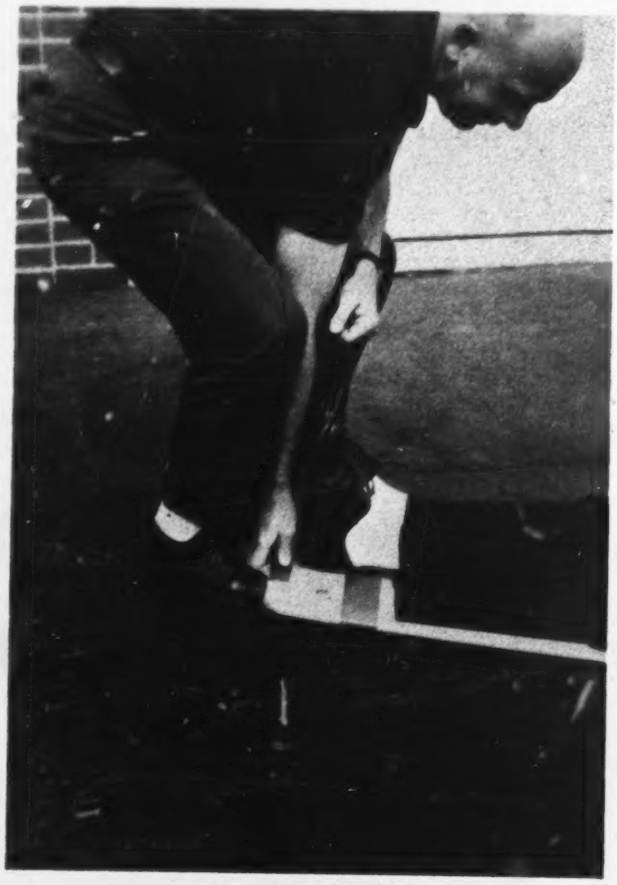


Figure 16

Squadman places board on his foot.

The top man places himself at the top of the board. He stoops, places each hand on one edge of the board, and slides his hands along the board toward him until they touch the ground. (See Figure 17.)

He then straightens his legs and lifts with his leg muscles, not his back. If both men keep their arms straight, the board can be carried easily. (See Figure 18.) Squadmen should not bend their arms while carrying a patient on a backboard, as it is very tiring.

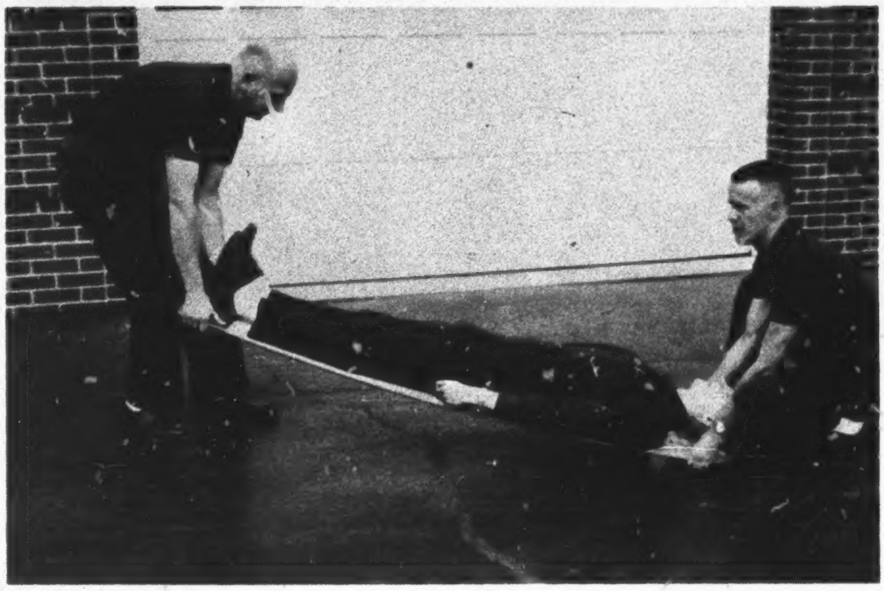


Figure 17

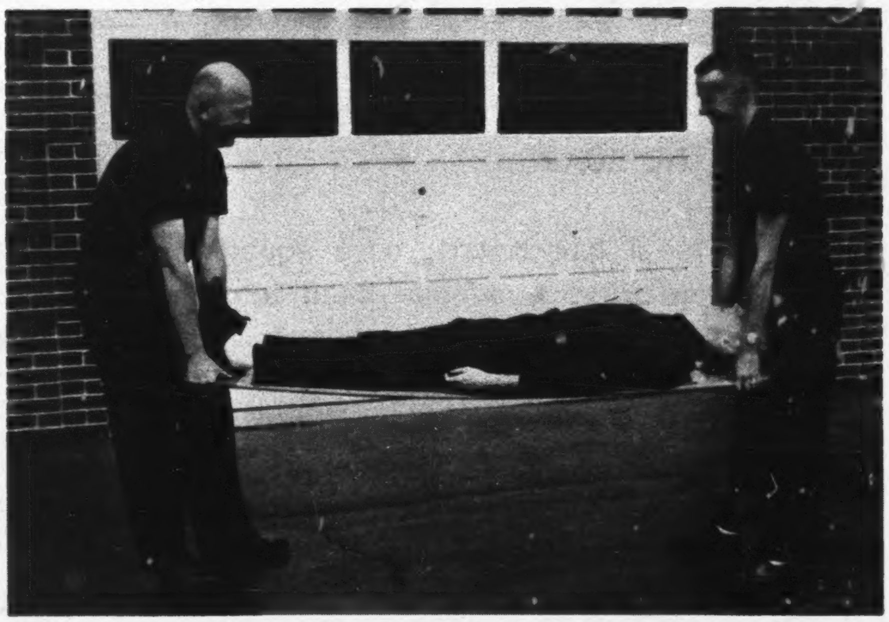


Figure 18

Figure 17 shows the proper first step in raising the board. Figure 18 shows the proper way to carry the board.

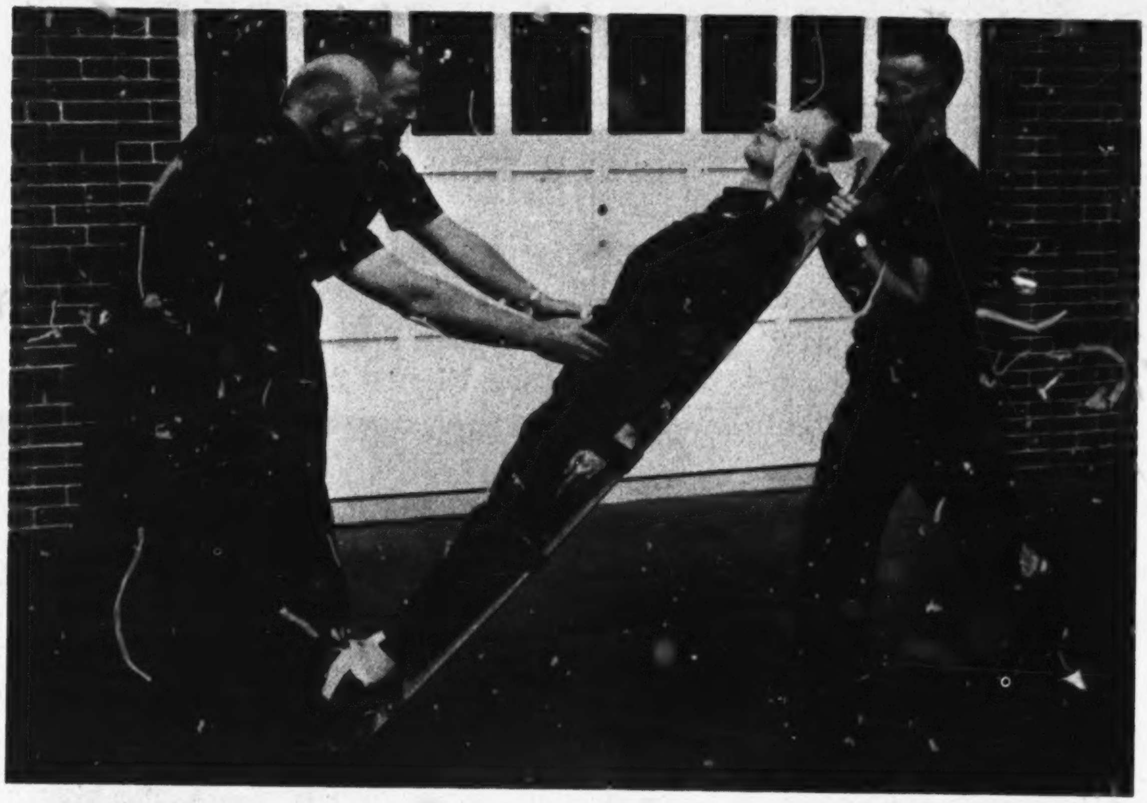


Figure 19

Squadmen raise the victim to a vertical position.

Raising Victim's Head - If the victim must be carried in a vertical position while strapped to the board he must be raised properly:

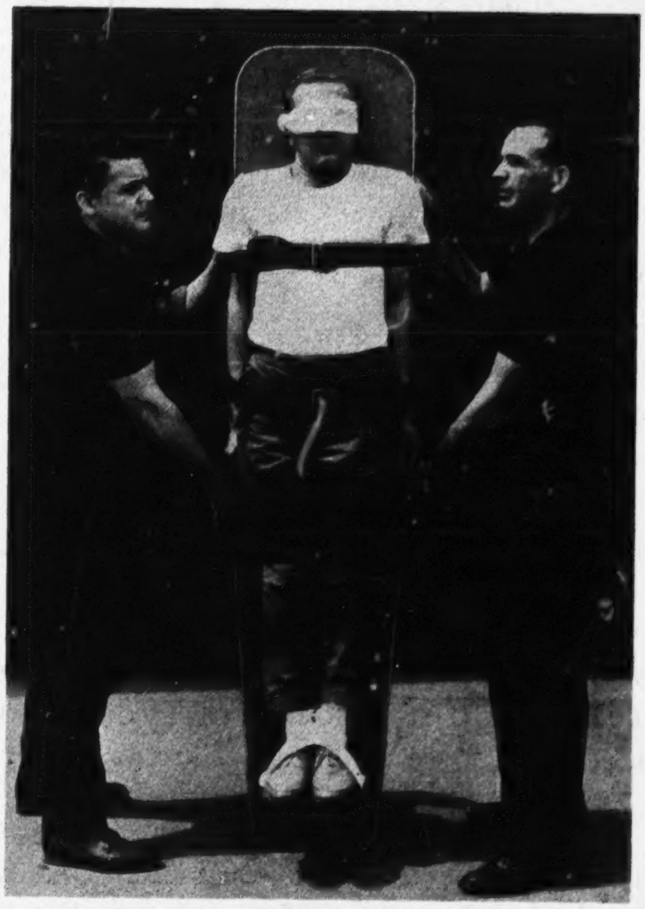
1. After the board is lifted to the normal (horizontal) carrying position, the foot end of the board is lowered again.

2. Two squadmen then "foot" the board; that is, each braces it with a foot.

3. The top man then raises the board to his chest, places it on his chest, changes the direction of his hand position, and pushes away.

4. The bottom two men then receive the board. (See Figure 19.)

The victim who is properly secured to a backboard can safely be raised to a vertical position using this procedure. He will not slide off or fall away from the board (See Figure 20.)



Courtesy Yorkville Vol. F.D.

Figure 20

The victim is secure in a vertical position.

REMOVING VICTIMS FROM AN AUTOMOBILE

Victims of auto accidents are especially likely to have head, neck, and back injuries. Moving these victims carelessly has resulted in needless deaths and permanent paralysis. Every squadman should learn the procedure for removing a victim from a car: (1) from the driver's seat, (2) from under the dashboard, (3) from a prone position on the front seat, and (4) from the back seat.

PRELIMINARY STEPS

All emergency first aid--control of bleeding, the splinting of all fractures, etc.--must be carried out before the victim is removed. (If danger of explosion or uncontrolled fire is imminent, the victim should be pulled from the car by the long axis of his body.)

The squadmen's hand positions on a victim in a car are the same---or as close as possible to the same---as in regular log-rolling.

The victim should not be moved until all are ready, and then only on the directions of one man.

Some of the procedures shown here require more men than usually are on a squad run. Other persons---policemen, family, or bystanders---could quickly be shown how to help. Do not hesitate to call for more help, if it is needed to carry out these procedures.

In the following pictures removal of a victim from each of the four locations is described and shown. The pictures do not show first aid treatment because they were posed: in an actual accident, the victim would have been splinted, etc.

REMOVAL FROM THE DRIVER'S SEAT

Rescuers often forget to make as much room as possible to work. Sliding the front seat back gently will give the squad more room. (See Figure 21.)

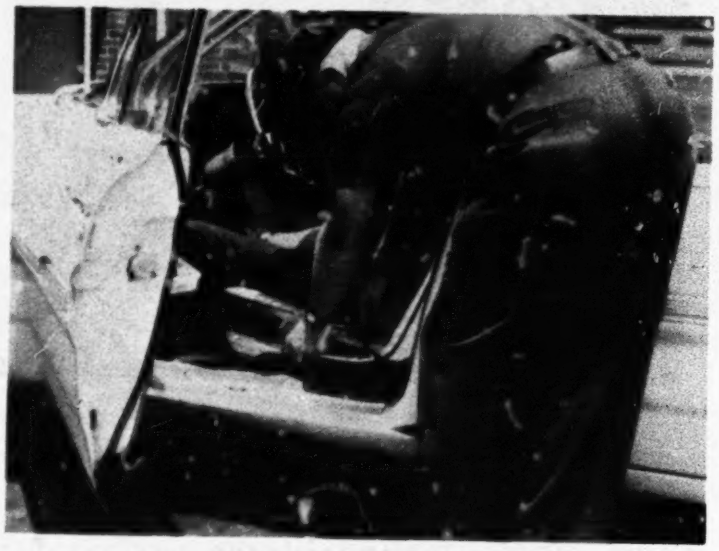


Figure 21

A car seat can be slid back.

A squadman positions himself behind the victim, in the back seat. (See Figure 22.) He slides his hands under the victim's armpits, grasps the victim's wrists, and crosses the victim's arms.

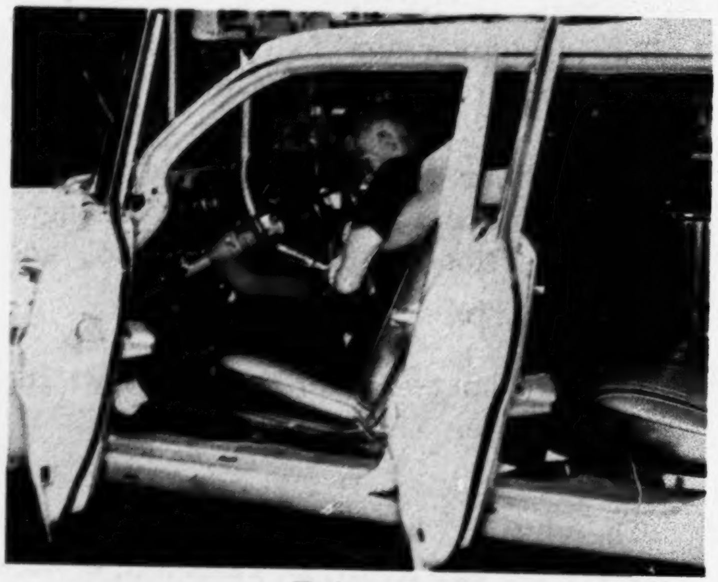


Figure 22

The victim is grasped by his arms.

As this is being done, one squadman stands ready with the backboard and another squadman stands at the opposite door.

The squadman in the car then arches his back against the car roof, and raises the victim just enough to slide the board under the victim. (See Figure 23.)

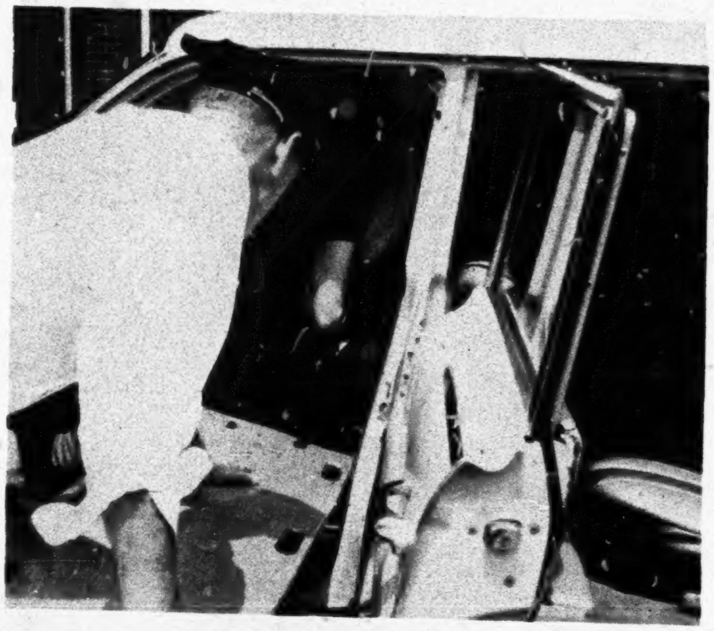


Figure 23

One squadman slides the board.

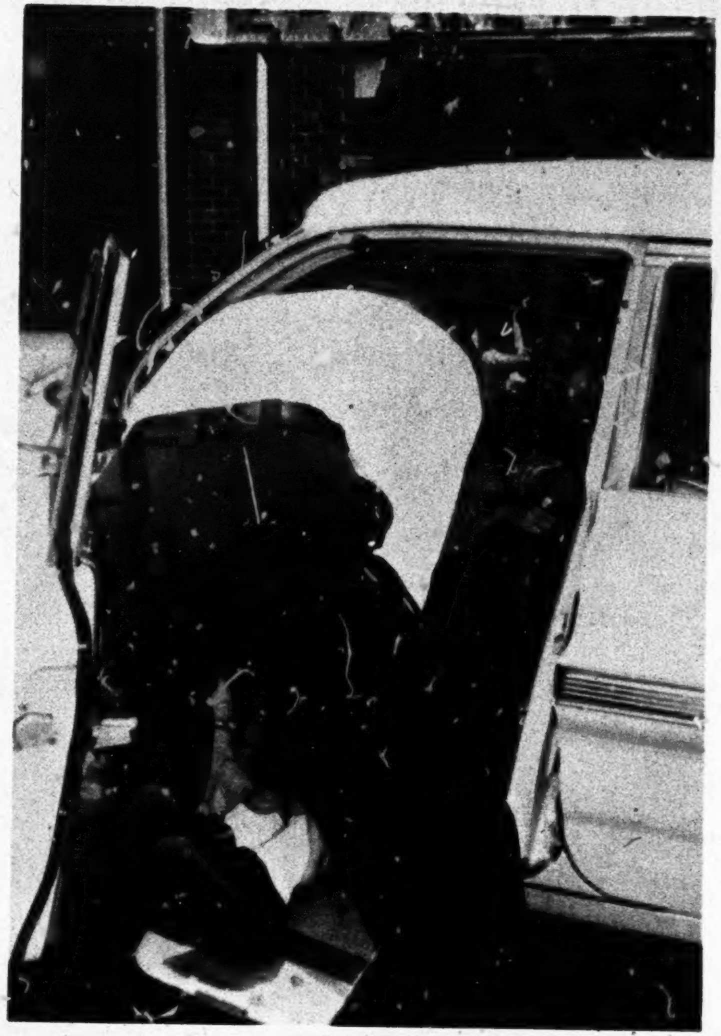


Figure 24

The victim is pivoted.

The victim is then pivoted on the board. Both his feet are kept together at all times. The squadman in the back seat then "gives" the victim to the squadman at the opposite door, who lowers him to a horizontal position. (See Figure 24.)

All three squadmen then come to the driver's side. Together they slide the victim out of the car. (See Figure 25.) He can then be transferred to the squad stretcher.

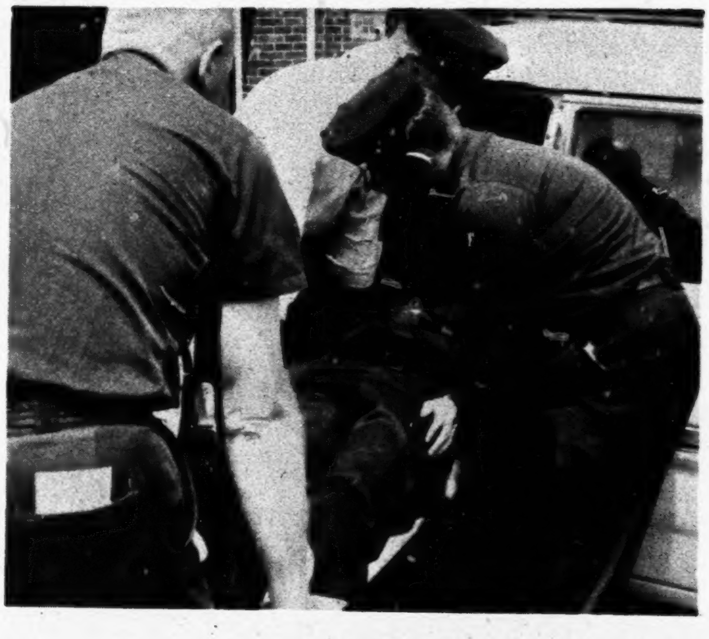


Figure 25

The victim is removed.

REMOVAL FROM UNDER DASHBOARD

A victim might typically be found in the position shown in Figure 26. Four squadmen will be needed, to remove him.

After the victim is given first aid, a board is placed on the front seat. (See Figure 27.)

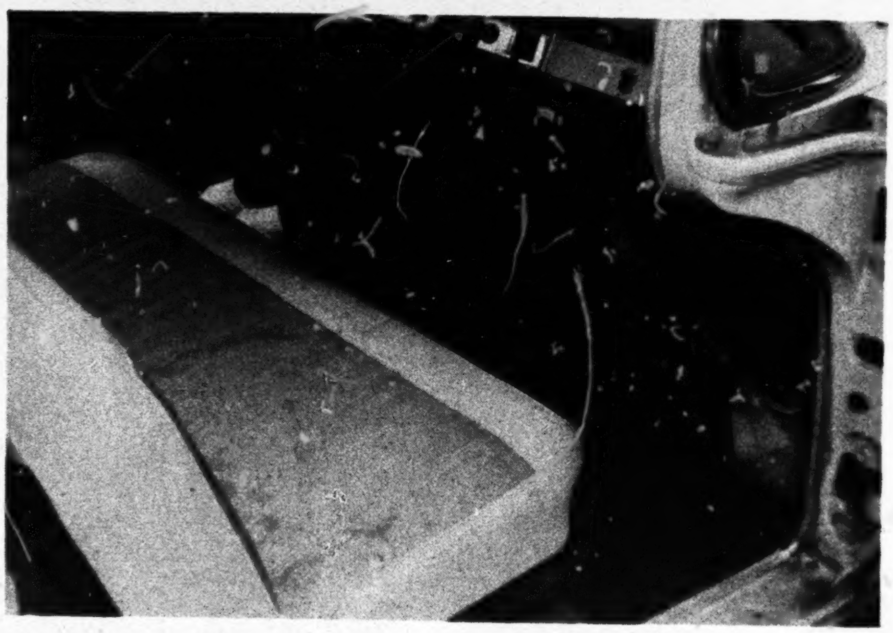


Figure 26

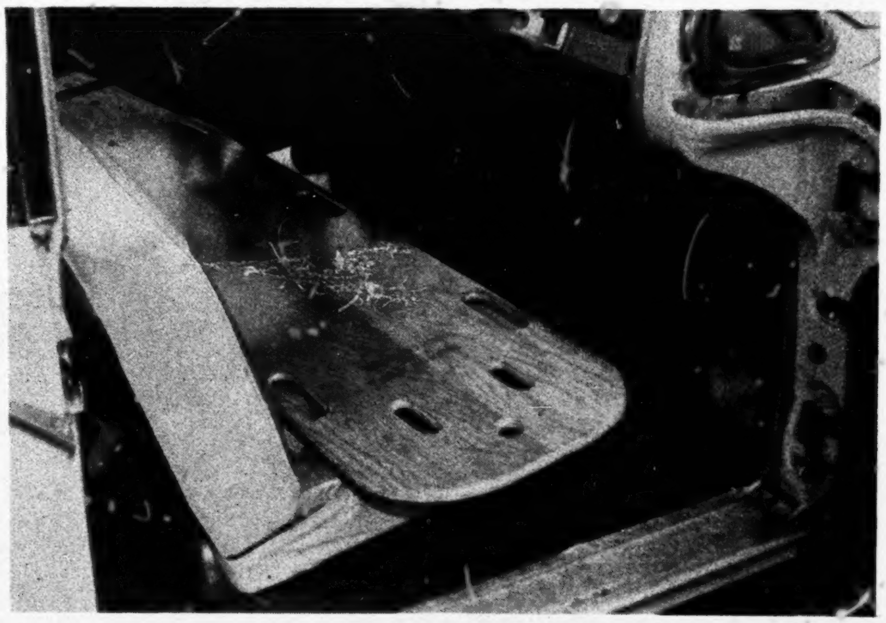


Figure 27

Figure 26 shows a victim lying under the dashboard of an auto. Squadmen, after giving him first aid, will place a backboard on the front seat as in Figure 27.

Then the rescuers prepare to roll the victim onto the board, as follows:

1. One squadman places himself so that he can support the victim's head. He controls its movement at all times during the maneuver.

2. One squadman places himself where he can support the victim's legs.

3. Two squadmen get into the back seat, reach over the front seat, and grasp the victim's clothing at the shoulder, chest, belt, and thigh. (See Figure 28.)

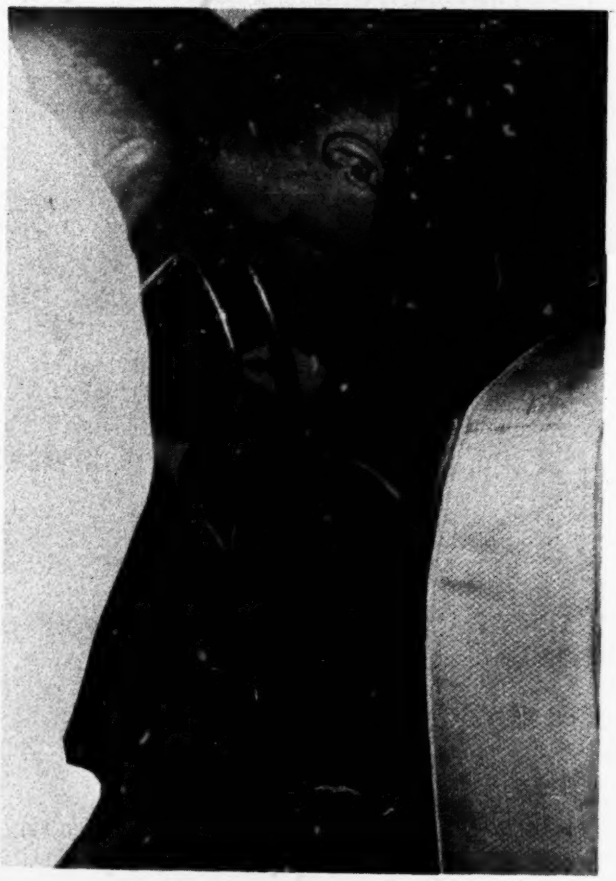


Figure 28

Squadman at left is attending the victim's legs. Squadman at right, reaching from the back seat, is grasping the victim's belt and thigh.

On a signal all four squadmen gently lift the victim, keeping his back and hips against the front of the front seat. (See Figure 29.)

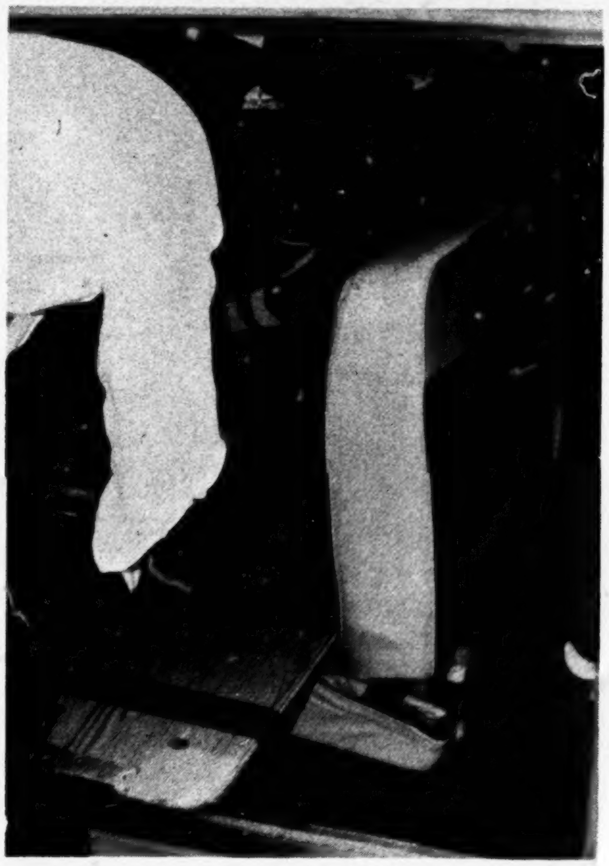


Figure 29

Four rescuers lift the victim from the car floor. One man in back, not visible here, holds the victim's chest and shoulder. Another is outside the car on the opposite side.

The victim is then placed on the board. (See Figure 30.)

The victim on the backboard is slid out of the car. (See Figure 31.) He can be transferred to the squad stretcher.

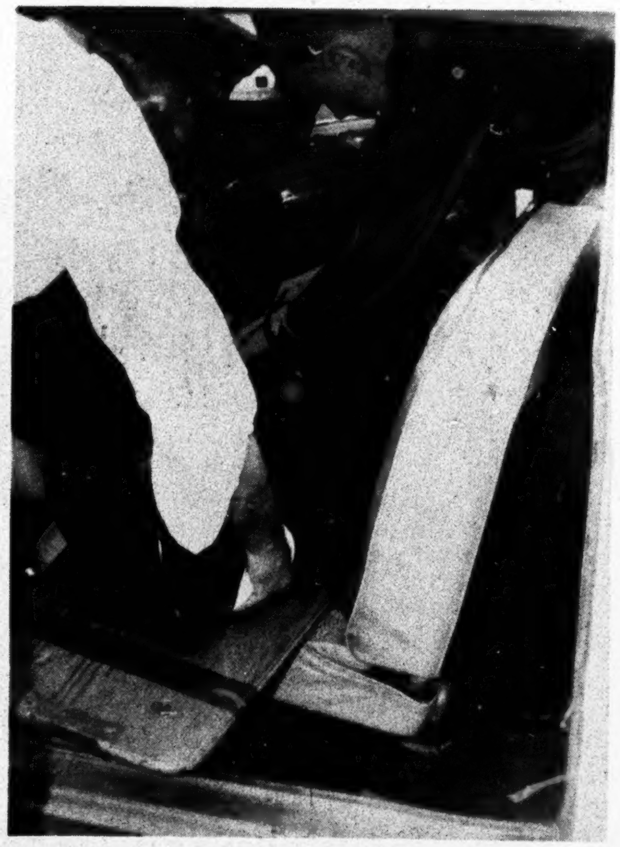


Figure 30

The victim is slid on a backboard.

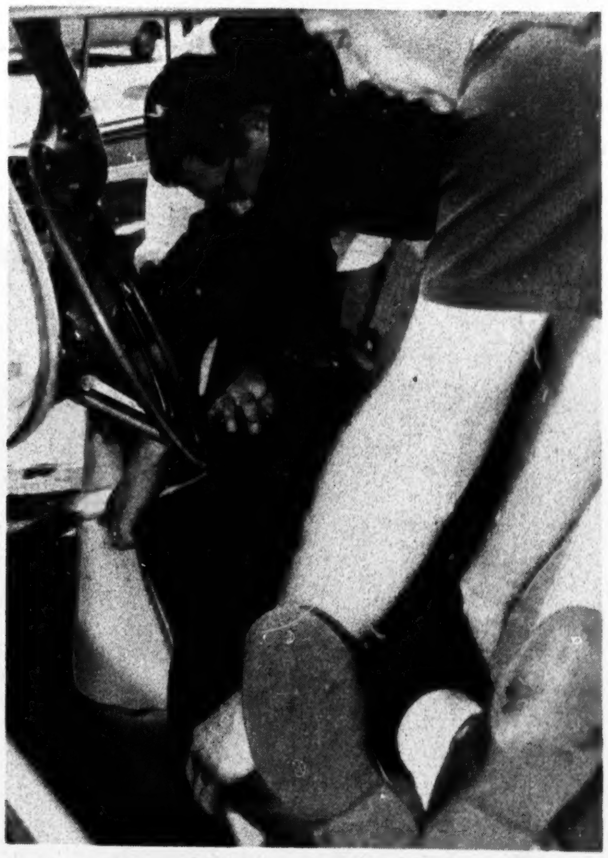


Figure 31

The victim, on the board, is removed from the car.

REMOVAL FROM FRONT SEAT

Many times a victim is injured and falls across the front seat.

Four men are also needed for this rescue procedure, as follows:

1. Two men get into the back seat. The top man supports the victim's head and grasps the clothing at the shoulder. The second man grasps the victim's clothing at the belt and thigh. (See Figure 32.)
2. One man outside the car prepares to guide the victim's feet.
3. One man handles the board. Later he will attend the victim's head.

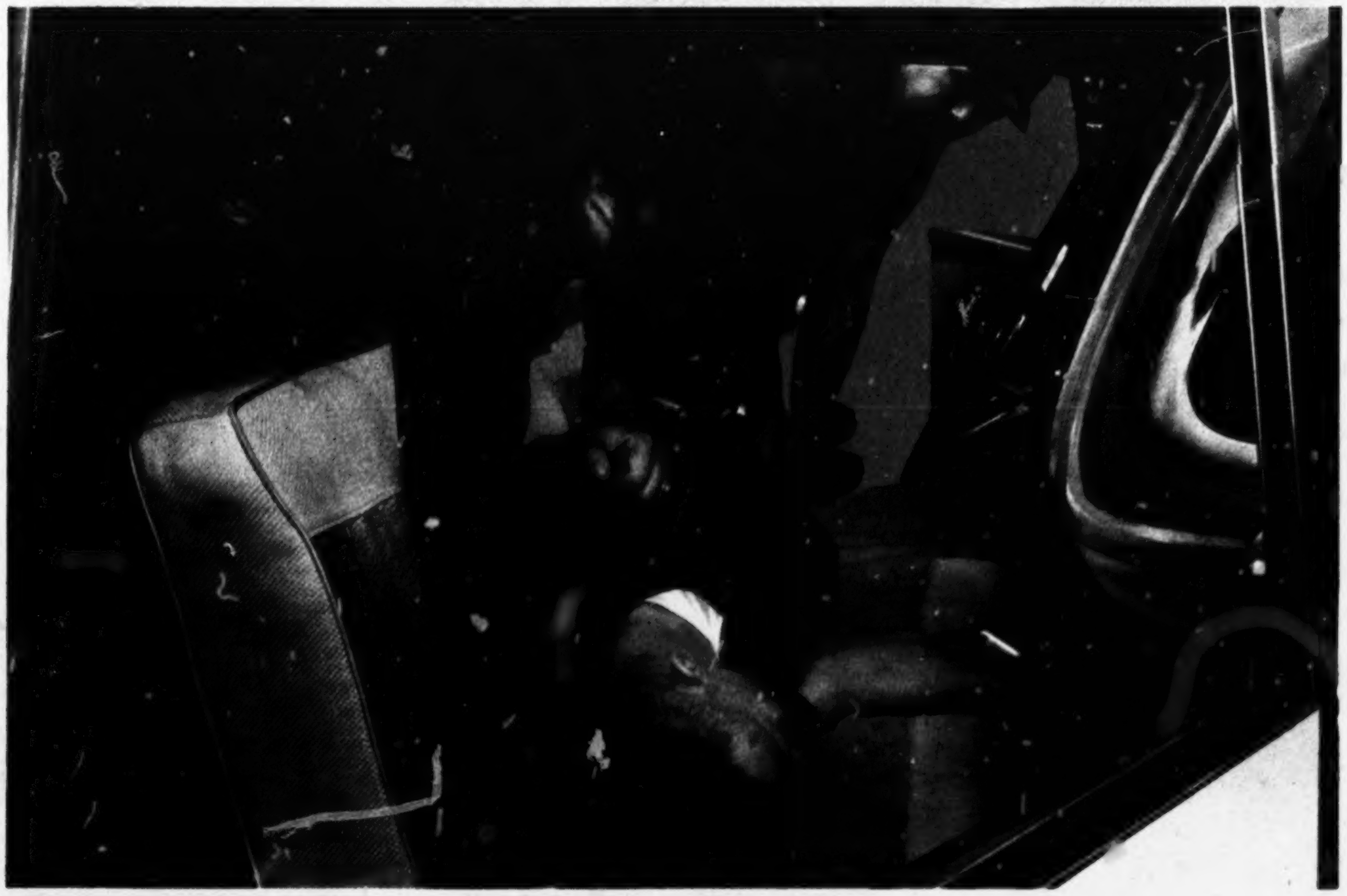


Figure 32

Rescuers are preparing to move the victim. Note positions of each squadman's hands.

The victim is rolled slightly away from the back of the seat, and the board is slid behind him. (See Figure 33.)

After the board is in place, the man who handled it becomes top man. He supports the head of the victim against the board with his arm, and grasps the bottom edge of the board. (See Figure 34.)

The two men in the back seat then reach across the victim, grasping his clothing under the ribs, waist, hip, and thigh. Together they hold the victim snugly against the board (See Figure 34.)

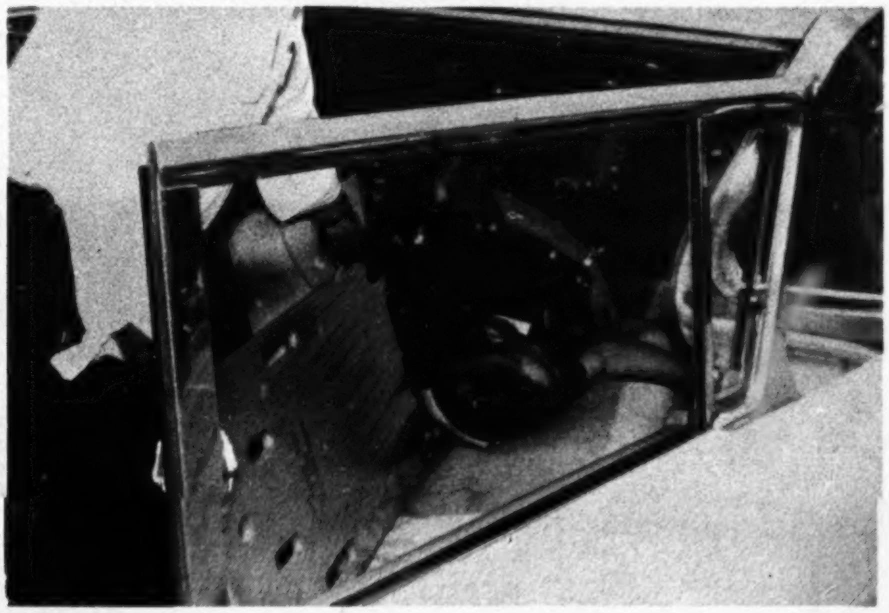


Figure 33

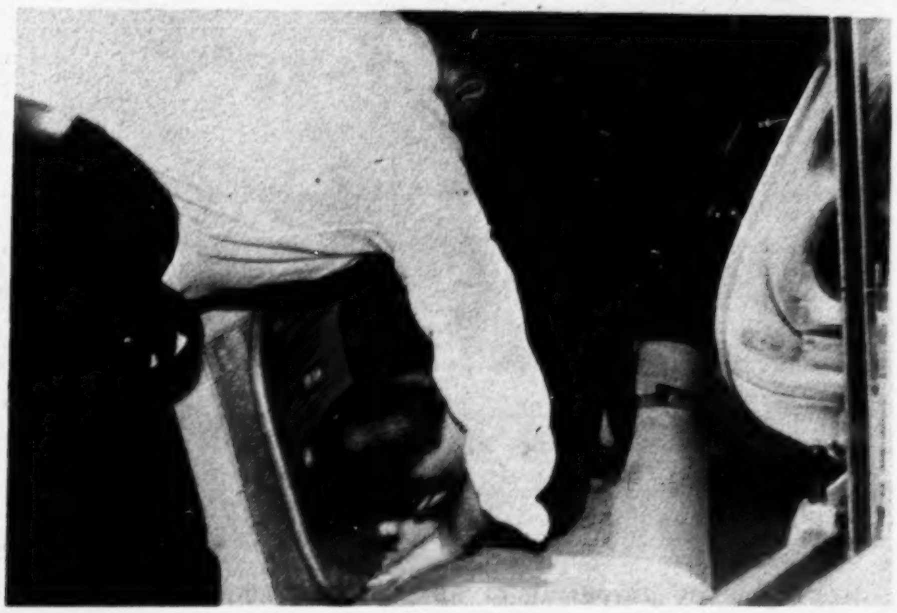


Figure 34

The victim is slightly rolled while one man places a board behind him (Figure 33). One squadman holds the victim's head against the board with his lower arm, as his hand grasps the backboard edge (Figure 34).

The bottom man (on the outside of the car) grasps the top of the board with his top hand. He reaches around the victim's ankles and grasps the board at its bottom edge, at the same time keeping the victim's feet against the board. (See Figure 35.)

On a signal all four men turn the board, keeping the victim tight against the board. (See Figure 36.)

The board is now resting on the front seat. The victim can be removed as previously shown.

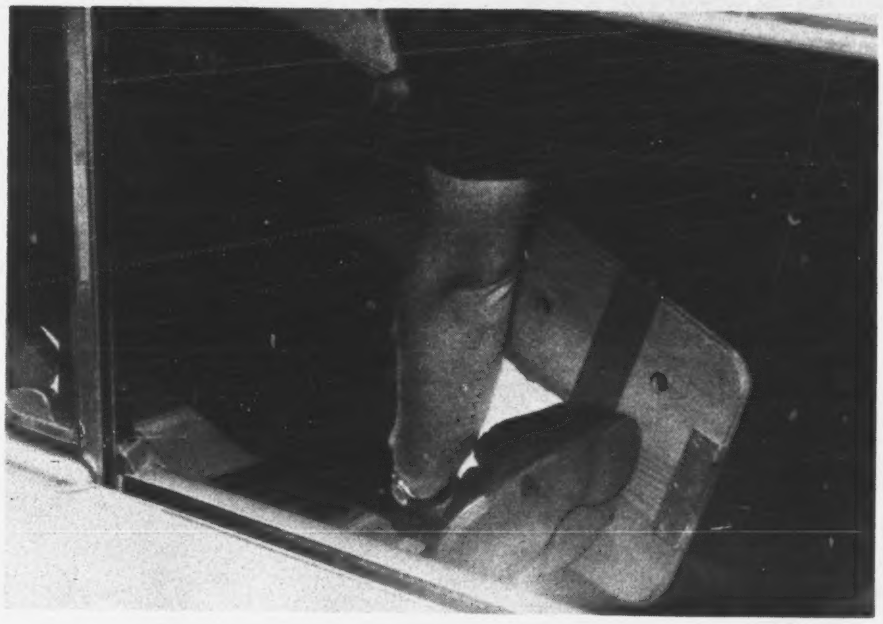


Figure 35

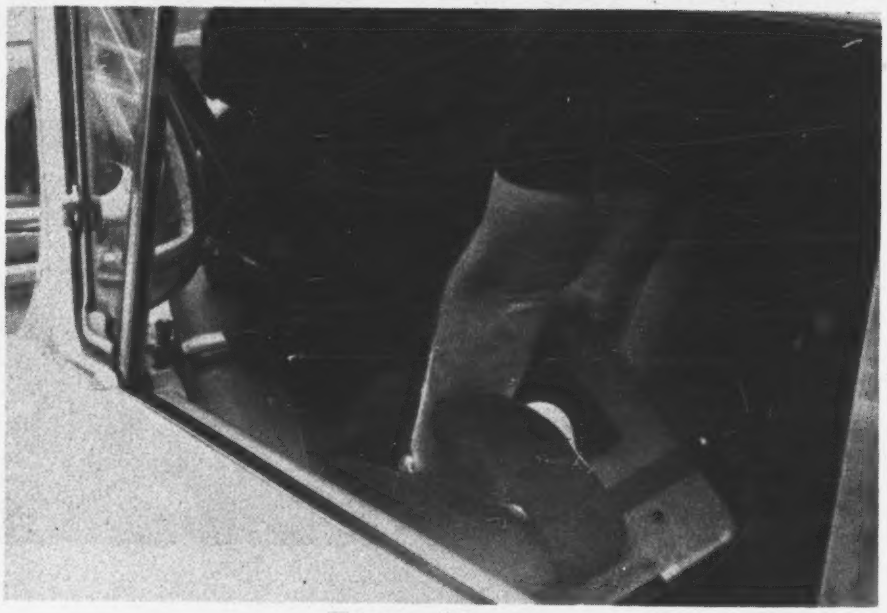


Figure 36

With his left hand another squadman grasps the backboard below the victim's ankles (Figure 35). His right hand grasps the hand hole. Lowering the board onto the car seat is a joint maneuver (Figure 36).

REMOVAL FROM THE BACK OF CAR

People riding in the rear seat of a car can as easily be injured in a wreck as those in the front seat. They sometimes are found in the position shown in Figure 37.

To remove this victim, four squadmen grasp him using the same hand position as those shown in Figure 32. However, the two squadmen in the car are in the front seat. These two men grasp the victim as shown in Figures 38 and 39.

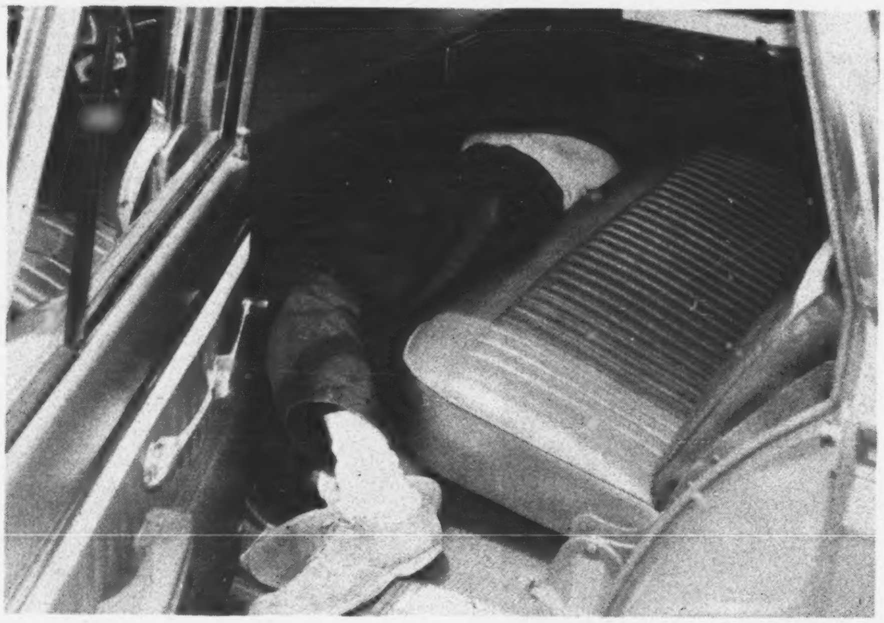


Figure 37

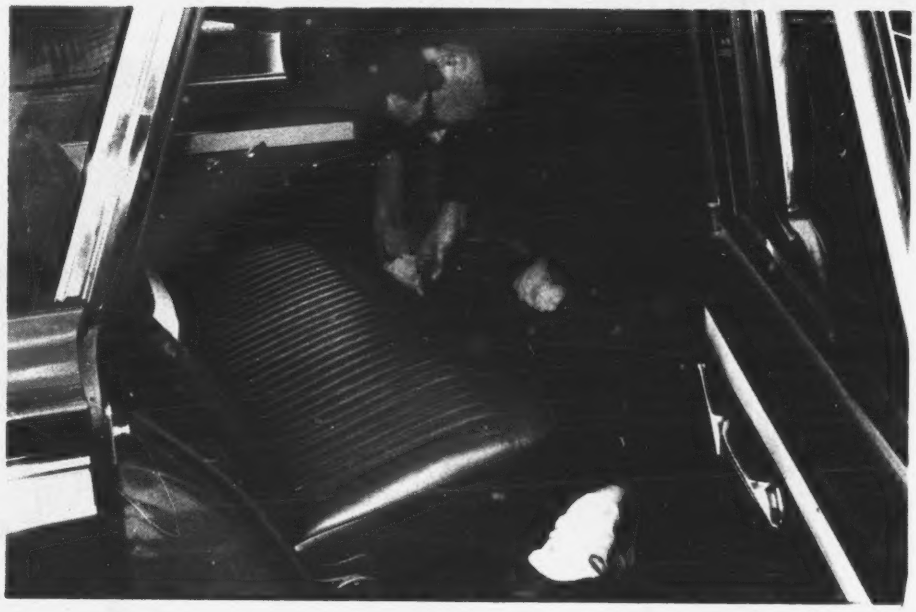


Figure 38

A victim lies on the floor between the front and back seats (Figure 37). Two squadmen, working from the front, grasp the victim as in Figure 38.

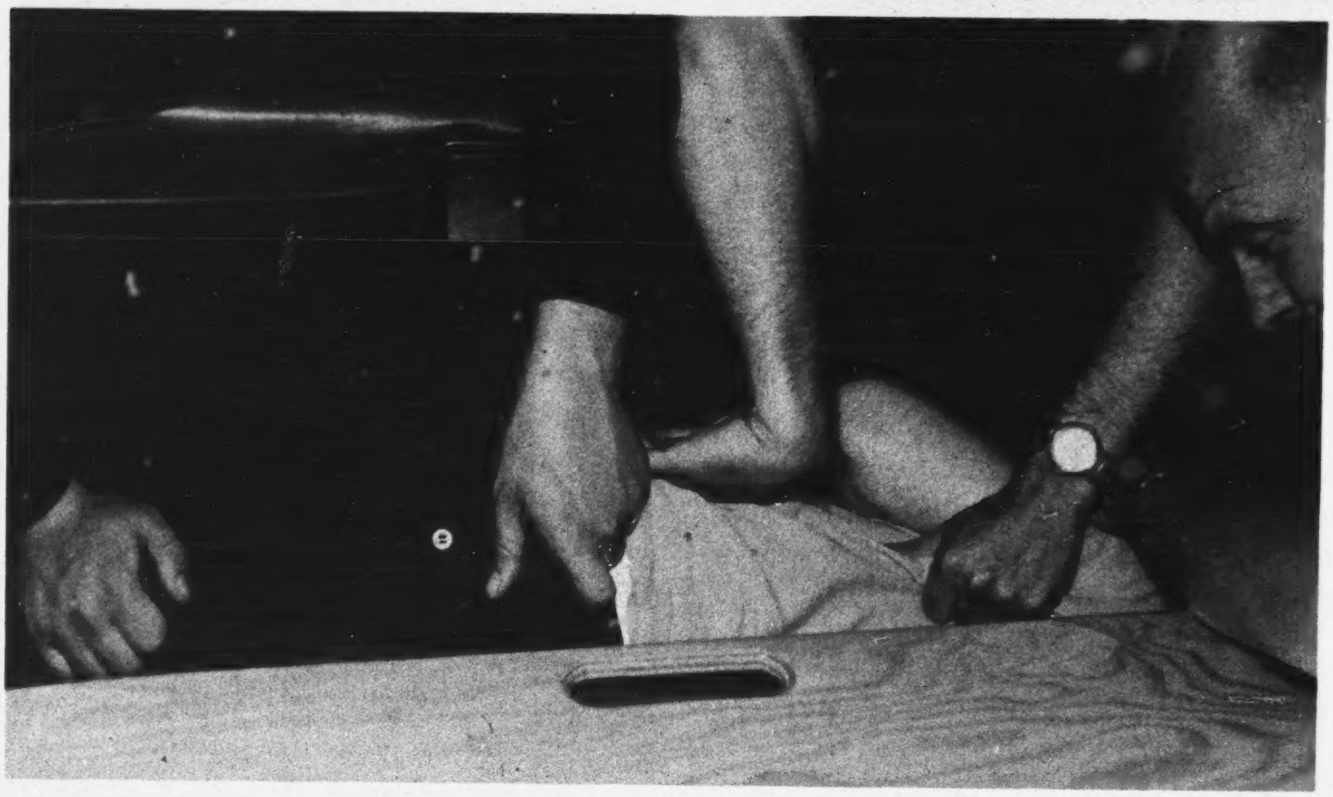


Figure 39

Squadmen place their hands on the victim as shown.

A board is placed on the seat and the victim is raised to the board. His back should be kept against the front of the back seat as support. His head, neck, legs, and back must be continually supported.

The back seat can be removed and the board put on the floor. The victim can then be supported and logrolled onto the board more easily. (See Figure 40.)

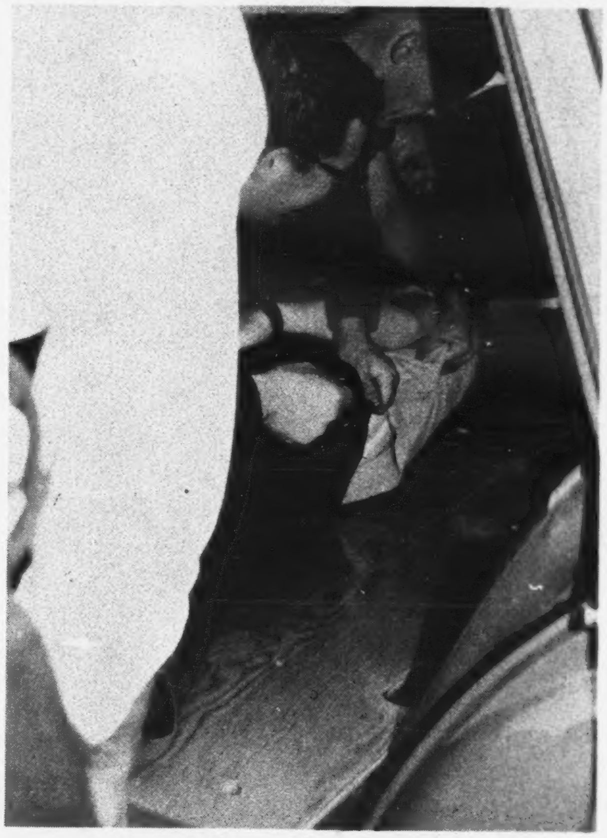


Figure 40

Rescuers place the victim on the board. In this view, the back seat has been removed from the car.

CONCLUSION

Other uses of the backboard---raising, lowering, aerial-ladder rescue, etc.---are shown in other parts of this text.

This versatile tool should be handled frequently in squad practice sessions, so that it will become an intrinsic part of your team operation.

A wrecked car should be obtained by every squad, and it should be used often at drills to practice removal of victims. The car can be turned on its side or top, and the victims can be brought out through side windows, and through the windshield or back window.

All pictures in this chapter, except Figure 20, were taken in cooperation with the Sharon Township Fire Department, Worthington, Ohio.

CHAPTER XIV

RESCUE CARRIES AND DRAGS

INTRODUCTION

Earlier chapters of this text have dealt with first aid. The next several chapters will describe rescue procedures.

An important aspect of rescue work is the successful removal of victims in situations where a stretcher or backboard cannot be used. Squadmen must be able to carry and drag victims quickly to safety in a variety of emergency situations, with minimum risk to the victims and to themselves. They must be prepared to rescue people who are injured or unconscious. This chapter describes rescue carries and drags.

RESCUE PRINCIPLES, PRACTICES AND EQUIPMENT

THE RESCUE SCENE

Rescue is the removal of humans from places involved in fire or other disaster. The factor of life saving or "life hazard" decides the first or immediate operating procedure at a fire or other emergency. Rescue is the first action to be taken on arrival at a scene. Therefore, each officer and squadman should thoroughly understand the principles governing rescue.

In case of emergencies within a building, the first questions to be considered regarding rescue are as follows:

1. Are there any people in the building?
2. If so, are they in danger?
3. Have there been cries for help?
4. Can the people be rescued?
5. How can they be rescued?
6. Has any information been given by persons who have escaped from the building regarding persons in the involved building?
7. Has any information been given by neighbors or bystanders regarding persons in the involved building?

The officer in charge should determine whether anyone is trapped in the building. The information secured from answers to the questions above will help greatly in making rescue.

Children may try to escape from flames or smoke by hiding in closets, under beds or furniture. Persons may be found beneath a window which they have tried to open. A careful search should be made when there is any chance of anyone having failed to escape from the involved building. It must be remembered that it only takes a small amount of heated air, smoke or gases to render a person unconscious.

PREVENTING PANIC

In such places of public assembly as schools, churches, hospitals, dormitories, theaters, factories and stores, the actual emergency is not the only factor causing a serious rescue problem. Panic has been the major cause of death in places of public assembly. A false shout of fire, the discovery of smoke, some incident such as an explosion, collapse of part of the building, or any other unexpected event can cause the necessary spark of excitement which can cause panic. The best method of panic prevention is for the assembled people to be trained to perform a well disciplined emergency exit drill. This is the reason that systematic emergency exit drills should be conducted. Where it is not possible or practical to train occupants in emergency exit drills, the only safeguard against panic is for the buildings to have adequate exits. All exits should conform with accepted standards.

COMPLICATING FACTORS

Weather conditions at the time of the emergency have an important bearing on the problem of rescue. Zero weather accompanied by snow and ice will slow up rescue operations. Low temperature, plus exposure, may endanger the health of persons who have been removed from the building.

The use of the new type metal window frames in buildings has increased the difficulty of bringing occupants out through window openings.

The time and nature of occupancy has a direct relationship to the problem of rescue. A hotel fire is a more serious problem in the early morning hours than at any other time. In the early morning, most of the occupants are asleep and a fire may have made considerable headway before discovery. A school building presents an entirely different problem during the time classes are in session than when they are not. So, time and nature of occupancy must be given proper consideration in rescue.

The age, sex and physical condition of the inhabitants of the involved building will also enter into the problem of rescue. Women, children, and the physically disabled will make operations more difficult.

BEING READY

Squadmen should make community surveys to determine where disasters or grave emergencies are most likely to strike. A complete record should be kept at all times as to location of homes for the aged, children's homes, jails, hospitals and other institutions.

Squadmen must know the life hazards found in public, commercial and apartment buildings under their protection. Squadmen should know the construction, interior layout, nature of contents, number of persons likely to be found in the building, location of interior and exterior stairways, other avenues of escape, and any other information of value in conducting rescue operations.

Squadmen should also know the exact location of all exits from the involved building and the openings in the roofs of the adjoining buildings which could be used in an emergency. Porch roofs, balconies, and in many instances, the roof of the involved building may provide a means of temporary escape from immediate danger for the occupants.

Periodic surveys of the area squadmen are to protect should be made by both officers and men to determine the type of rescue tools and equipment that would be required for any emergency that may arise.

Rescue equipment will vary in different locations. For instance, an area with railroad tracks creates the possibility of a train wreck. The presence of lakes, ponds, and other bodies of water may indicate the chance of future drownings. Asylums, jails, etc., constitute places of confinement where iron bars would have to be removed from the windows. All of these would pose different problems in attempting rescue. Discussions should be held regarding these possible rescue problems.

Squadmen must be trained in the use of rescue equipment such as ladders, ropes, and gas masks in order to protect their own lives and the lives of others. A knowledge of the chemistry of fire, gases, ventilation and first aid is a must for the squadman.

There can be no set rules for rescue, as conditions may differ from case to case. Generally the time factor is always pressing, for people must be rescued quickly and taken to a place of safety. The methods used may employ one or a combination of rescue practices.

In order to be ready for any emergency, squadmen must be drilled regularly to develop teamwork in rescue practices.

CARRIES AND DRAGS

Persons who have been subjected to intense heat, heavy smoke, gases, or falling materials may become injured or unconscious. Squadmen should know the methods for carrying and dragging people to safety in such emergencies. Some common methods are described here.

Chair Carry - This is a good method. It is even better than a stretcher in places where sharp turns must be made or where steep stairways are encountered. The chair should be tested before use, to make sure it is solid and will support the victim. After the victim is placed in the chair, the man in the rear tilts the chair back to enable the man in front to get into his position. Carry as shown in Figure 1.

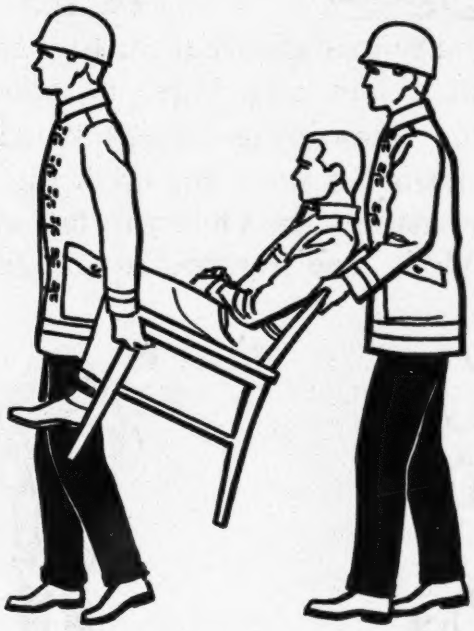
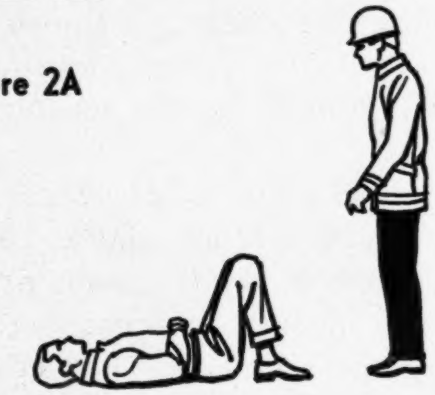


Figure 1
Chair carry

Fireman's Carry - To get the victim on the shoulder for this carry, balance and co-ordination of movement are very important. With this method, a squadman can raise any victim that he is able to carry. He places the victim on his back, knees up, and feet against buttocks, as shown in Figure 2a.

Figure 2A



He then grasps the victim's wrists with his palms down. See Figure 2b.

Figure 2B

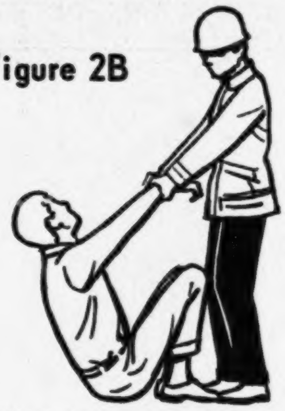
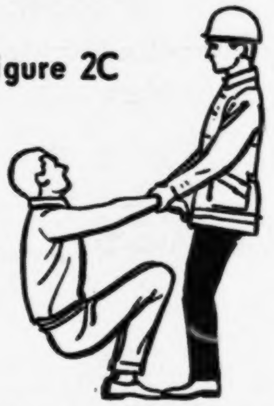


Figure 2C



The rescuer places his feet and legs against the victim's feet and legs, as shown in Figure 2c. Then, by leaning back and pulling the victim forward and up at the same time, he enables the victim to fall across his shoulder. See Figures 2d and 2e.

Figure 2D

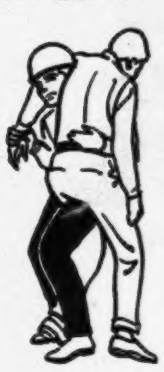
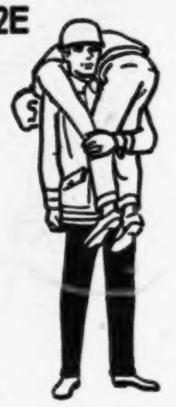


Figure 2E



Fireman's carry

Carrying in Arms - To carry a patient in the arms, lift him, if he is unconscious, to an erect position as described in the fireman's carry. Support the patient with one arm about the body. Kneel on one knee and allow him to rest on your other knee. Pass your other arm under his thighs. Roll the patient into the hollow of the elbows and rise. See Figure 3.

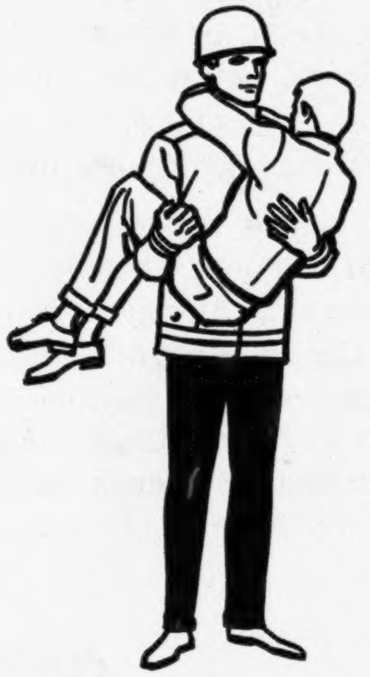


Figure 3

Carrying in arms

Carrying Astride Back - Carrying astride the back is a comfortable one-man method of transportation, but is limited to carrying a conscious victim who can at least partially stand alone. The rescuer assists the victim to a standing position. Standing in front of the victim, he turns his back to him, taking the victim's arms over his shoulders and crossing them. He then bends forward until the victim rests on his back. He grasps each thigh, and with a humping motion, raises him well upon his back. Passing the forearms under the victim's legs, the rescuer then takes a wrist in either hand and the victim is loaded. This carry is so secure that the victim may become unconscious and yet be carried safely and easily. See Figure 4.

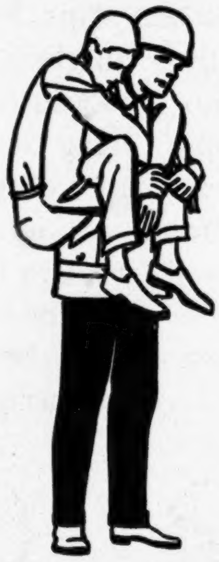


Figure 4

Carrying astride back

Pack Strap Carry - The pack strap method is a one-man carry that has two applications, one for a conscious and one for an unconscious victim. For a conscious victim, the loading is done exactly as described in the first part of the "astride back" method. See Figure 5a. When the victim is on the rescuer's back, the rescuer grasps his crossed arms at the wrists, bends forward, humping the victim well up on his back and proceeds in the manner shown in the illustration. Note that the rescuer has one hand free.

If the victim is unconscious, the loading is more difficult, likewise the carry. To make the carry, an improvised "pack strap" is used. The carry gets its name from the pack strap used. The pack strap consists of a loop of some type of material. A rope hose tool is excellent for this purpose, but a bed sheet or any other similar material may be used. The rescuer turns the victim on his back and passes the loop through, under his shoulders at the arm pits. He then places his body on that of the victim with his face up, slipping each arm through an end of the loop. The rescuer then rolls himself and the victim over, gets to his knees, then to his feet and from this squatting position rises to an erect position. See Figure 5b. Since both hands are free, the rescuer may proceed down a ladder or through difficult passages. Although the dangling legs of the victim are awkward, he cannot slip from the load. Also, the rescuer can shift the load from his back to leg muscles by bending forward.

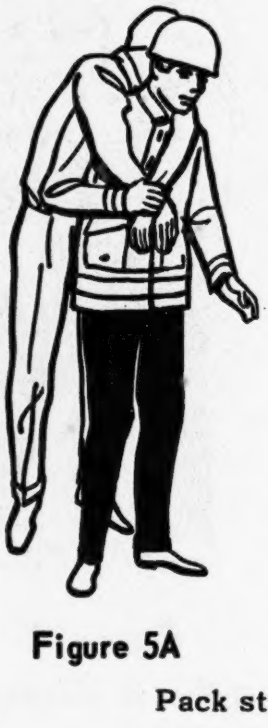


Figure 5A

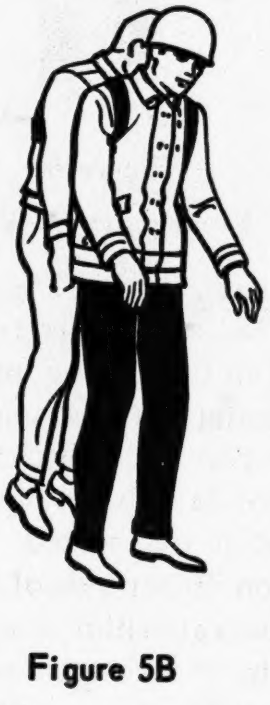


Figure 5B

Pack strap carry (conscious and unconscious)

Front Piggy Back - This one-man carry is excellent for carrying a conscious victim. To get the victim in position, face him and place hands under his arm pits. Lift as he jumps up putting his legs around your midriff, above the hips. The victim wraps his arms around the rescuer's neck. The rescuer has both hands free to climb or descend a ladder, open a door, etc. If trouble develops while descending a ladder, the rescuer can pin the victim against the ladder until help arrives or the trouble is eliminated. See Figure 6.

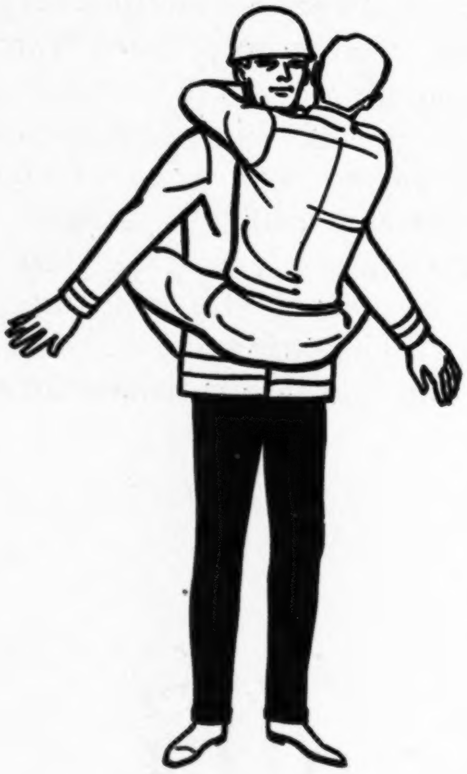


Figure 6

Front piggy back

Two-Man Seat Carry - The seat carry seen in Figures 7a and 7b is a two-man means of carrying an injured or unconscious person. It consists of making a seat rest of one pair of arms and a back rest of the other pair. Figure 7a shows how the arms are arranged when completed. The rescuers kneel, one on either side of the victim near the hips, and raise him to a sitting position steadying him with the arm nearest his head around his neck.

Each rescuer then slips his other arm under the victim's thighs, clasping the wrist of the other rescuer. Both arise slowly, in unison, lifting the victim from the ground. When erect, they adjust their upper arms to form a comfortable back rest and to make the victim secure. See Figure 7b. If conscious, the victim assists the rescuers by grasping them around the necks with either or both arms.

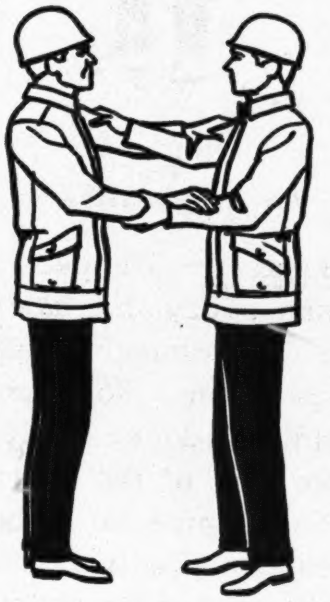


Figure 7A

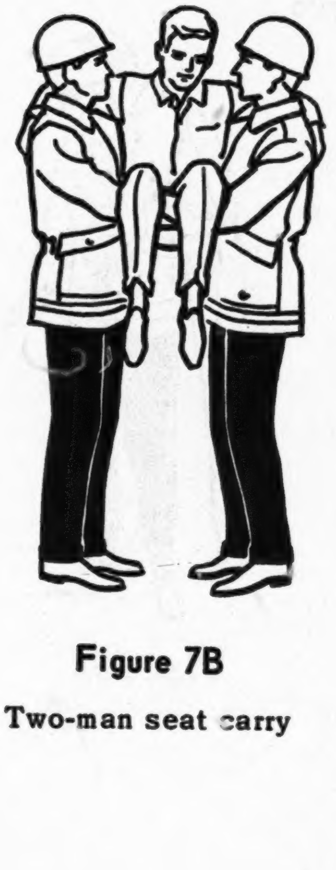


Figure 7B

Two-man seat carry

Carrying By the Extremities - This is a good method, but should not be used if the victim has any fractures. The victim is laid straight on his back, feet apart. One rescuer takes his place between the victim's legs and the other at his head, facing each other. The rescuer at the victim's feet turns his hands palms down, grasps the victim's wrists, and pulls him to a sitting position. The man at the victim's head assists in raising him to a sitting position by lifting his shoulders. See Figure 8a.

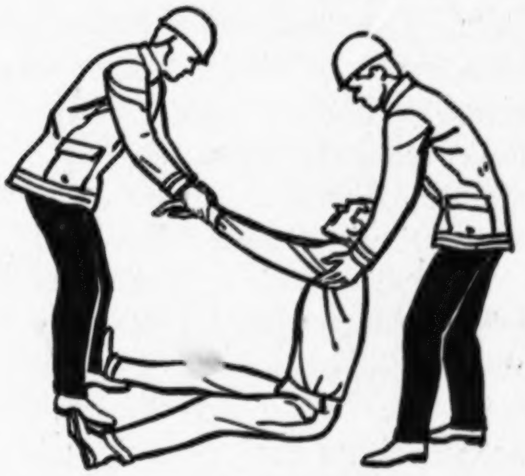


Figure 8A

The rescuer at the head position kneels on one knee and supports the victim's back with the opposite knee and leg. Then he extends his hands, palms down, under the victim's armpits from back to front. The rescuer at the victim's feet, who has been holding the victim's wrists, places them in the extended hands of the other rescuer, who grasps them firmly. See Figure 8b.

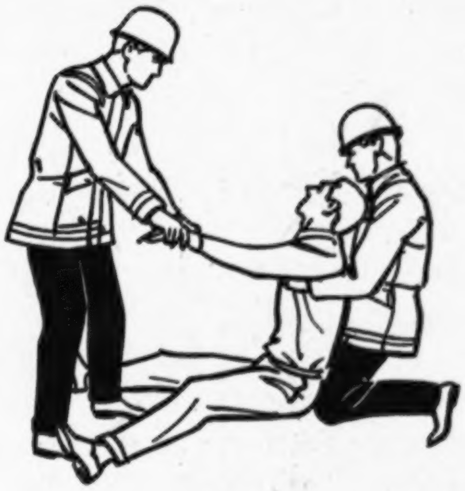


Figure 8B

The rescuer at the victim's feet turns his back to the victim, kneels on one knee, and passes his hands under the victim's knees from the outside. The rescuer at the head position gets into a baseball catcher's position, keeping his back vertical. At the order "Rise", by either of the two rescuers, both rise by straightening their legs, and move forward. See Figure 8c.

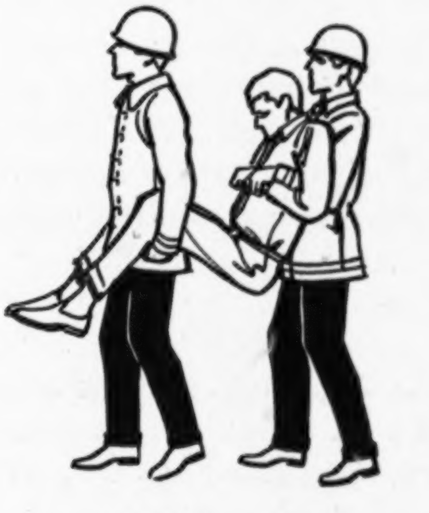


Figure 8C
Carrying by the extremities

Three-Man Carry - The three-man carry is used for badly injured persons. See Figures 9a , 9b and 9c . The carry is accomplished as follows: Three men line up on one side of the victim and the leader gives the command, "Prepare to lift." Each man kneels on the knee nearest the victim's feet, so that one man is at his shoulders, one at his hips, and one at his knees. Without further orders, they pass their hands and forearms under the victim, as shown in Figure 9a . The one at the head places his hands under the victim's neck and back, the second under the pelvis and hips, and the third under the knees and ankles. At the command, "Lift," they raise the victim and place him on their knees, but without releasing their hands. See Figure 9b.

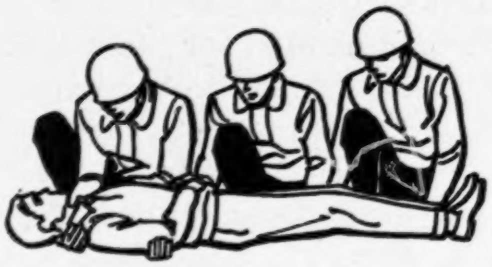


Figure 9A

At the command, "Prepare to rise," they slowly turn the victim on his side, toward them, until the victim rests in the bend of their elbows. At the command, "Rise," all rise to a standing position, holding the victim against their chests, as in Figure 9c. To move directly forward, the command, "March," is given and all three step off on the left foot and continue until the command, "Halt" is given. To move sideways, the command, "Side step left", (or "... right",) is given. The rescuers step off with the foot according to the command, bringing the other foot up to it in even, short steps. The victim is then lowered by reversing the operations but always at the command of the leader.

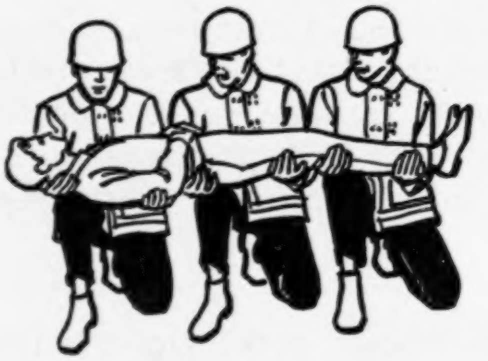


Figure 9B

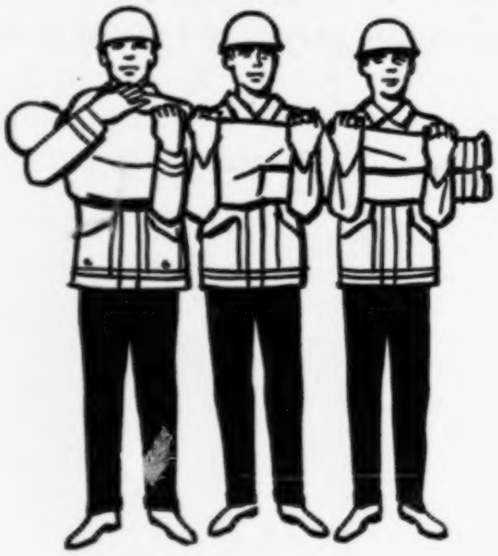


Figure 9C

Three-man carry

In actual practice, however, it should not be necessary to give detailed commands. The men should be so well trained that they can move and act in unison with a minimum of commands.

Clothes Drag - When a squadman must rescue a victim who is too heavy to be carried, other means must be used to get the victim to safety. The clothes drag, Figure 10, is one method that can be used. The rescuer's hand should grasp the victim's collar with the victim's head resting on the rescuer's arm for protection.

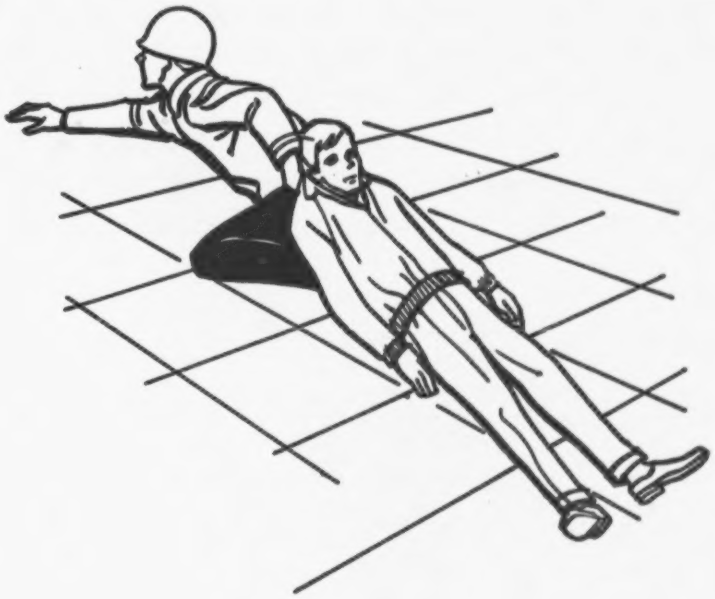


Figure 10
Clothes drag

Fireman's Drag - In making a fireman's drag, the victim's wrists are tied together with a square knot as shown in Figure 11.

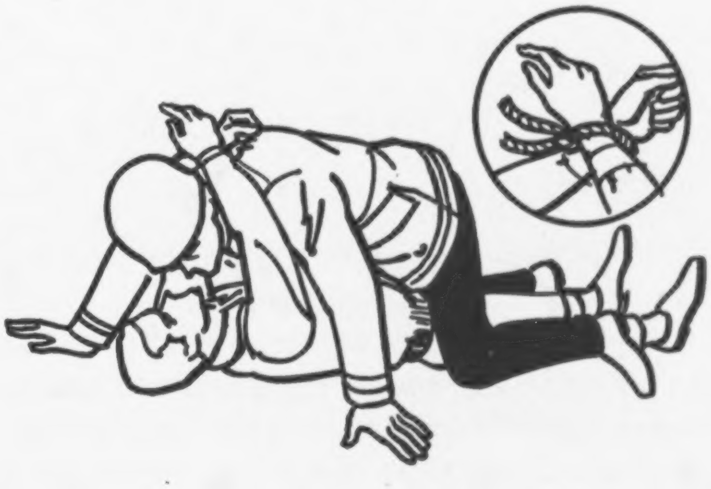


Figure 11
Fireman's drag

The rescuer then straddles the victim and passes his head between the arms, raises the victim's head and shoulders just off the floor, and then, by crawling, drags the victim out.

For descending a stairway when using the fireman's drag, the rescuer's position is reversed and he descends the stairs backwards. This prevents the victim's head from hitting the steps.

The Blanket Drag - The blanket drag can be used in place of the clothes drag when the victim is nude or the clothing being worn is too flimsy to be used to drag the victim. Place a blanket on the floor and roll victim onto the blanket. The victim can then be removed to safety as shown in Figure 12.

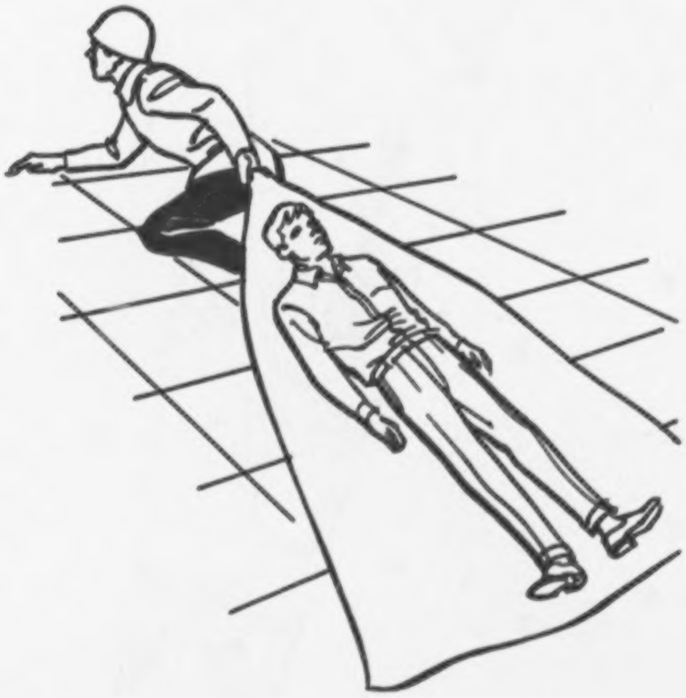


Figure 12
Blanket drag

LADDER RESCUES

SLIDING AN UNCONSCIOUS VICTIM DOWN A LADDER

Generally this evolution, illustrated in Figure 13, is started from a crotch-hold position. The rescuer unlocks his own leg, works up until his arms are beneath the victim's armpits, grasps the rungs in front of the victim's face, while the rescuer's knee is beneath the victim's crotch. The victim's feet are positioned outside the beams and he is slowly slid down the ladder. The rescuer should be backed up by an extra man.

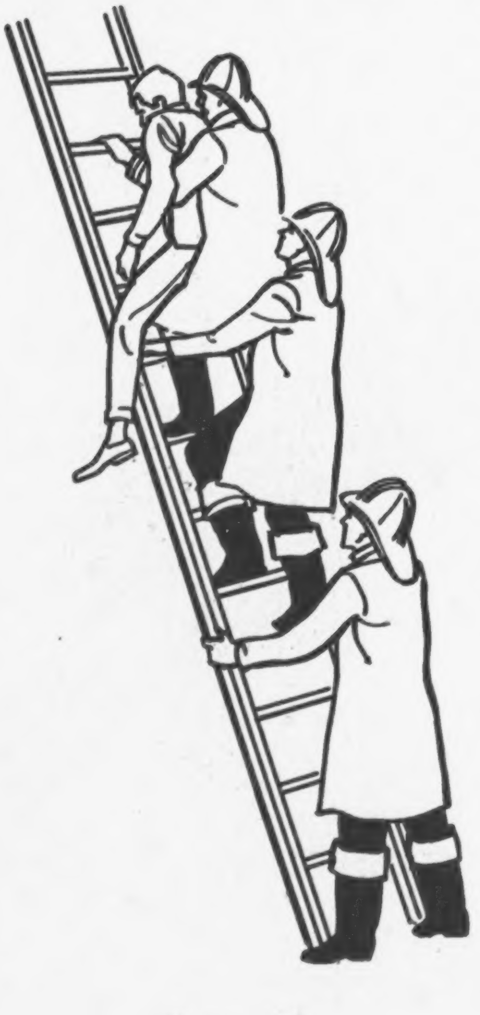


Figure 13

Sliding an unconscious victim down a ladder

WALKING A VICTIM DOWN A LADDER

As shown in Figure 14, this evolution is executed by taking a position immediately behind and parallel to the victim, but one rung below him. Place the arms around the victim's body below the armpits and grasp a rung. Using one rung at a time, descend slowly. As a precautionary measure the rescuer should keep one knee between the victim's legs to prevent him from sliding through.

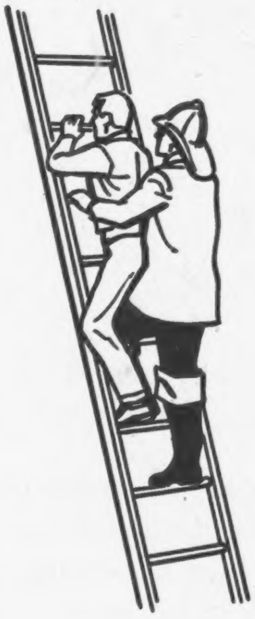


Figure 14

Walking a victim down a ladder

WALKING A WOMAN OR CHILD DOWN A LADDER

This evolution differs from the preceding method because the rescuer's knee is not placed between the legs of the woman or child. The rescuer's arms are placed around the victim's body below the armpits. The resucer graps the rung immediately below the rung the victim is grasping. He comes down slowly, descending one rung at a time.

Figure 15 shows the proper way to walk a victim down an aerial ladder.

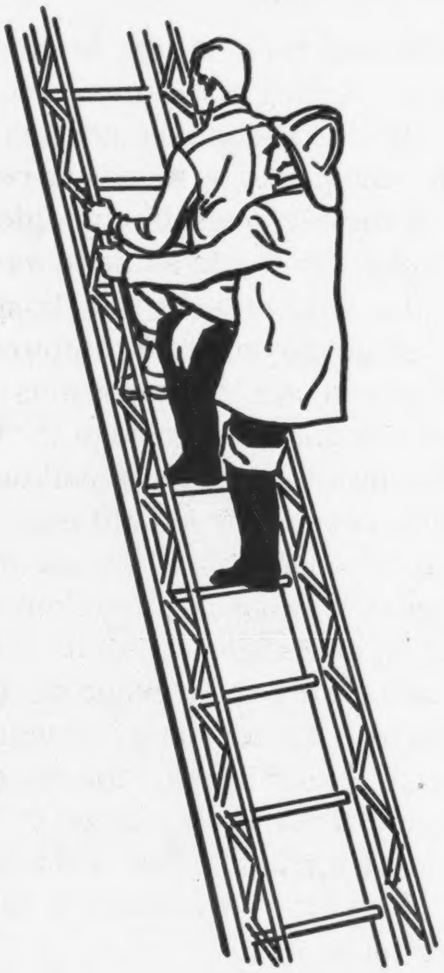


Figure 15
Walking a victim down an aerial ladder

SLIDING A VICTIM DOWN A LADDER)ER ACROSS ARMS

The rescuer who is to slide the victim down the ladder stands on the ladder just below the door, window, or roof, grasping the ladder with both hands on the underside of the beams. The other rescuer places the victim across the first rescuer's arms, as shown in Figure 16a. The first rescuer then descends the ladder one step at a time with the victim's buttocks resting on each rung of the ladder during descent. The rescuer's hands are slid along the underside of the beam. The rescuer on the ladder should be backed up by an extra man. See Figure 16b.

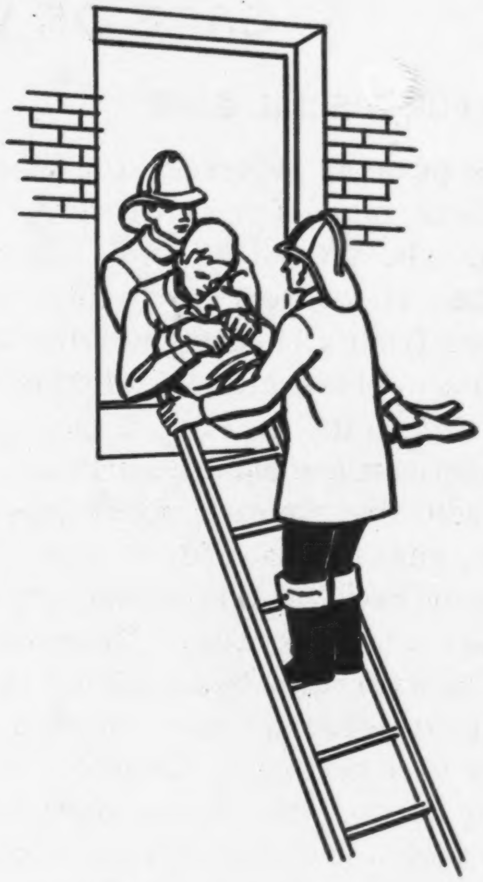


Figure 16A

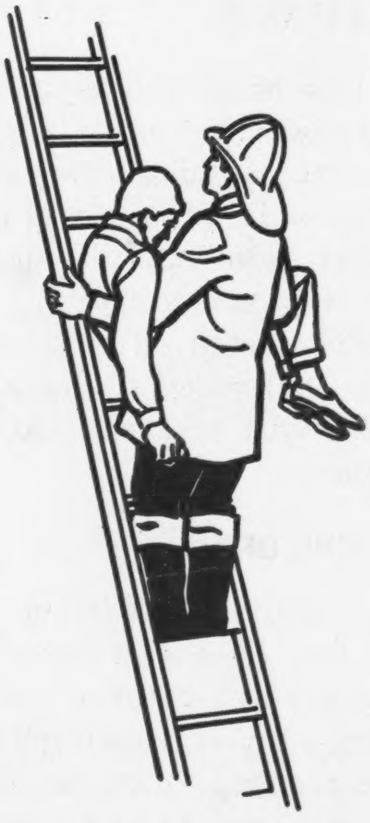


Figure 16B
Sliding a victim down a ladder across arms

CARE OF VICTIMS AFTER RESCUE

NEED FOR SPECIAL CARE

The persons referred to in this section are those taken from or removed from danger who are not injured. Care should be taken to prevent persons who have escaped from a burning building from reentering to obtain clothing or other possessions left in the building if the conditions are such as to endanger their lives or interfere with fire-fighting operations. Many times, rescue is a difficult and dangerous operation even for trained and experienced firemen or squadmen. Therefore, care must be exercised by squadmen to prevent untrained persons from exposing themselves to unnecessary danger.

The duty of the rescue squad does not always end after persons are brought to a place of safety. Infants, children, the sick and the aged all need care and supervision after being brought to safety.

CARE OF INFANTS

When infants are subjected to a sudden drop in temperature after being removed from a heated building, they are likely to incur pneumonia or some other illness. The rescuer should protect them by being sure that they are properly covered and their face protected. They should, if possible, be delivered to some competent person who will see that proper care is given to them.

CARE OF CHILDREN

If left on their own, children may wander around a fire area and become injured. They may even re-enter a burning building seeking a toy or something left behind. For these reasons, they should always be placed in the custody of a competent person who will give them proper care and protection.

CARE OF THE SICK

People taken from a sick bed may suffer a relapse causing the illness to become worse. If the illness is not contagious, refuge for them may be found in a neighbor's home. If the sickness is contagious, provisions must be made as soon as possible to have the patient sent to a hospital. A heated garage may provide temporary shelter, but attendance and care must be given to the patient until removed to the hospital. As a precaution, as few squadmen as are absolutely necessary should expose themselves to a contagious disease. Those squadmen that were exposed should receive a doctor's attention and their clothing should be treated to prevent the spread of the disease. Since not all hospitals will admit contagious cases, the squad should prepare itself for this emergency by listing hospitals or agencies that will accept such cases. Refer to section on contagious diseases on page 62.

CARE OF THE AGED

On many occasions, aged people have lost their lives after being taken to safety. Not realizing the danger, they re-enter the involved building for their possessions which might have been only a picture, the contents of a dresser drawer or some other object they have had for a long period of time. If possible, squadmen should bring these cherished objects out with the person. In every case, however, after rescue the person should be placed in the custody of competent persons.

ROPE SLIDE

On some occasions ladders or other tools are not available and the squadman must use a rope slide to save himself and/or the victim.

PLACING THE SLIDING ROPE IN SERVICE

The rope is either carried to the roof or upper story of a building or pulled up with the aid of a small line such as used on the life gun which shoots the line to the upper story or roof.

Fasten one end of the sliding rope to some solid object within the building or on the roof. It should be tied at the same level as the edge of the roof or window sill over which it is passing, and directly above the center of the window from which the slide is to be made. Place a pad, such as a coat, under the rope where it passes over these edges to prevent damage to the rope. Be positive that the sliding rope is long enough to reach the ground or a place of safety. The following method is used to slide the rope with the hands and feet.

1. Stand erect in window if possible.
2. Grasp the rope with both hands high above the head and pull on rope. This will test the rope and take the slack and stretch out of it.
3. Still pulling with the hands, and with the lower part of the rope hanging down in front of the body between the legs, pass the right leg forward on the right side of the rope, backward on the left side of the rope, and forward on the right side again, far enough that the rope is hanging down on the inside of the instep of the right foot. See Figure 17a.
4. Extend the right leg out of the window just below the sill and suspend the full body weight with the hands and at the same time pass the left foot under the right foot and press it tightly to the outside of the right foot. Elevate toes of the left foot and lower toes of the right foot. See Figure 17b.
5. By pressing the feet together enough friction is created to hold a man stationary. By releasing the pressure slightly he can slide slowly and safely down the rope. Do not slide hands on rope but use hand-over-hand method. If the rope slips out from between the feet while sliding, suspend the body by the hands and work the rope back to proper position with the feet.
6. When getting on a sliding rope from the level where the rope is secured, as from a roof top, grasp the rope with both hands and lie on the stomach, over the rope, with the lower part of the body hanging down over the roof ledge. Work the rope into position as shown in Figure 17b and then lower yourself over the edge with the hands until you are in proper position for the slide.

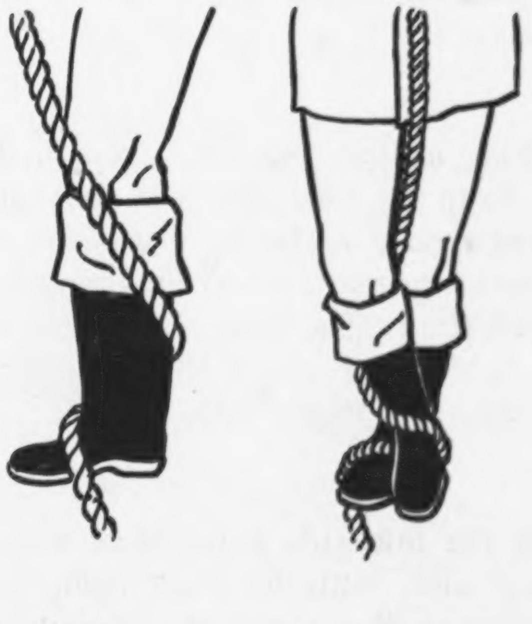


Figure 17A Figure 17B

Foot positions on sliding rope

TO SLIDE ROPE WITH A LIFE BELT - ONE MAN

Strap a life belt snugly about the waist (not so tight as to cause discomfort) with the buckles on the left side and the hook hanging directly in front. Put a leather sliding glove on the right hand. Stand erect in the window, facing the outside. Grasp the sliding rope with both hands, above the head, and pull down hard to test the rope for security and to take out some of the stretch.

Reach down with the gloved hand (right) and take hold of the rope just above the knees and raise it to about the level of the waist to give enough slack to work with. Hold the rope in the palm of the right hand, thumb up. Raise the life belt hook with the left hand so that it is pointing upward. Still holding the rope in the palm, grasp the base of the hook with the right hand and hold them firmly together just above the waist. The hinged or opening part of the hook should be on the left. Grasp the rope a bit above the hook with the left hand, thumb pointing down. See Figure 18a.

Looking at the left hand from underneath, wrap the rope clockwise one and a half turns around the hook, forcing the rope to the inside of the hook through the hinged part each time. The rope will be entwined one complete turn about the hook on its right side. See Figure 18b.

Hold the left side of the hook with the left hand and, with the right hand on the rope below the hook, pull the rope through until all the slack is out of the rope above.

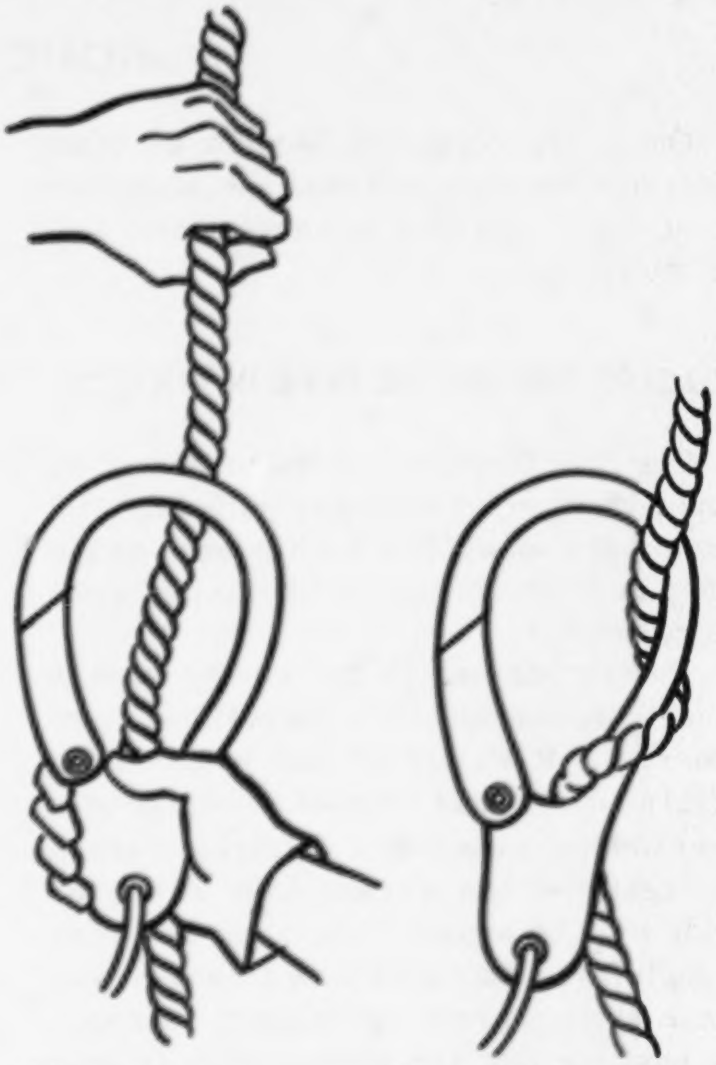


Figure 18A **Figure 18B**

One-man slide

Grasp the rope with the gloved right hand, thumb up; straighten the right arm and move it around to the rear of the body and hold the hand (thumb side toward the body) pressed firmly against the center of the buttocks. Have the rope gripped tightly and pulled taut around the right hip.

Remove the left hand from the hook. Bend slightly at the knees and allow the rope to suspend part of the body weight. Turn to the right until the back is to the outside and at the same time ease down until the body is suspended entirely by the rope and the legs are holding the body out from the building with the feet resting against the edge of the sill.

When ready to descend, kick out away from the building slightly and ease the right hand grip on the rope just enough to allow the rope to slide through the hand. The speed of descent is controlled by the amount of friction created by the righthand grip. To slow up or stop sliding it is only necessary to grip the rope more tightly.

During the slide keep facing the building. Keep the left hand off the rope and hook. Use the left hand and the feet to keep from striking the building during the descent. It may be necessary to kick out from the building several times on the way down, depending on the length of the slide and speed of descent.

Should the right hand become dislodged from its position in the rear of the body and be pulled up to or near the hook, stop at the most convenient place, such as the next lower sill, and work it back into position.

When the ground is reached, bend at the knees and allow the hook to slide down the rope as low as possible; then stand erect. By holding the hinged part of the hook open with the right hand, the rope is removed from the hook with the left hand, in reverse of the manner of putting it on.

Not more than one sliding life belt can be in use on one rope at one time.

TO SLIDE ROPE WITH A LIFE BELT - TWO MEN

Although no more than one life belt can be in use on the rope at one time, it is possible for two men to descend the rope at the same time. This is performed as follows:

They can both start the slide from the same window, or one man can start from above and pick the other man up at a lower level.

If both men are to slide from the same window, the first man wraps the rope two and a half turns around the hook instead of one and a half. See Figure 19. This extra turn is necessary to create enough friction for the added weight of the second man. He then gets into position with his back toward the outside and his feet holding himself out away from the building the same as in the one-man slide.

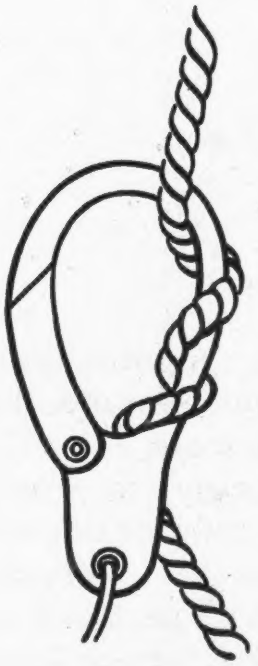


Figure 19

Two-man slide

When the first man is in position, the second man sits on the sill with his legs out the window and between the legs of the first man.

The second man holds onto the first man's belt toward the front with his left hand; with his right hand he snaps his own life belt hook into the ring at the base of the first man's hook. Then he holds onto the first man's belt with his right hand and holds his head and shoulders in close to the first man's waist.

He then eases himself out the window, off the sill, until he is entirely suspended by his hook from the first man.

As he eases himself out off the sill, the first man kicks out away from the building and they descend to the ground in the same manner as in the one-man slide. The second man may also assist in protecting both of them from striking the building during descent if necessary.

If the first man is to pick the second man up at a lower window, he gets on the rope and slides down to that window the same as in the one-man slide. He stands erect in that window, facing the outside, gets the necessary slack in the rope, places the extra turn around the hook, and takes the position with his back to the outside again. The second man then hooks onto the first man as previously described and they descend to the ground.

Upon reaching the ground the second man unhooks from the first man; then the first man stands erect and removes the rope from his hook.

A 5/8" cotton braided rope is recommended for this evolution.

RADIATION RESCUE

The atomic age promises many benefits to man, but with these benefits come added responsibilities and dangers to the squad service -- namely, to protect the public and squadmen from the dangers of radiation and contamination. More information on this subject will be found in Chapter 26 of the Ohio Fire Service Training Manual.

In case of an emergency where radioactive material is present, the victim must be removed from the area with as little contact with the rescuer as possible. The rescuer may use the clothes drag, a pike pole, or a rope effectively to remove the victim to a safe place. He should take any necessary measures to save life, but carry out a minimum amount of first aid until a doctor can be called to the scene. A squadman's protections against radiation are time, distance, shielding, and gas masks.

CHAPTER XV

AERIAL LADDER RESCUE PROCEDURES

INTRODUCTION

There are rescues in which the squadmen are unable to bring the victim up from a low place or down from a high spot in the usual way. Roofs of buildings and the bottoms of cliffs are two examples of such locations. In many such situations, where conventional rescue procedures are unsafe, the skillful use of an aerial ladder and appropriate rigging will permit squadmen to reach and rescue a victim with minimum risk.

If on arrival squadmen find that an aerial ladder will be needed, it should be sent for immediately. The squad should be prepared for this kind of emergency by learning the location of all aerial ladders that can be summoned to the area that the squad serves.

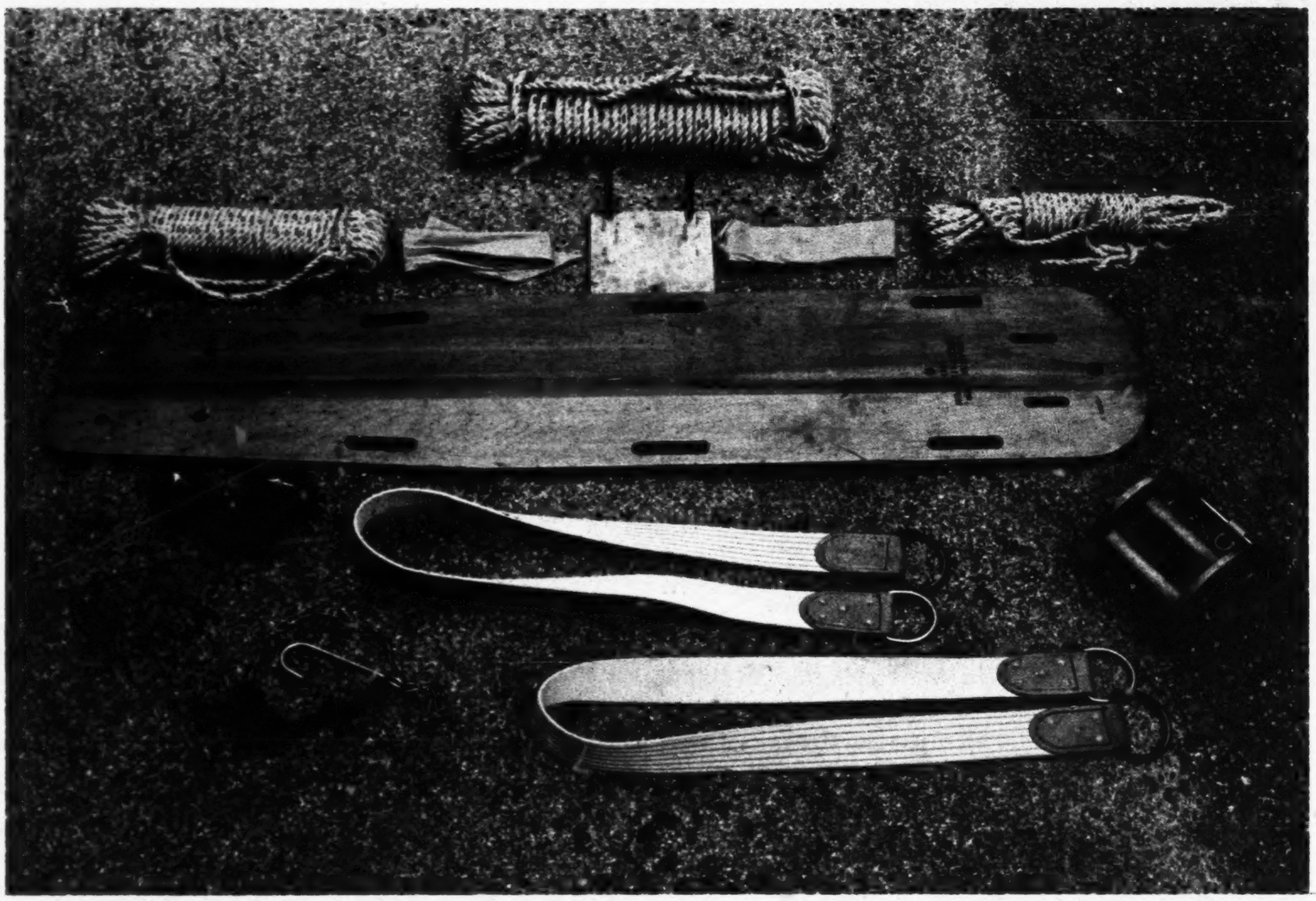
EQUIPMENT

The equipment needed for aerial ladder rescue includes:

1	Backboard and footrest
2	Long web belts (7-foot)
3	Leather straps
1	Blanket
2	Triangle bandages
1	Hose roller
2	1/4-inch or 1/2-inch ropes
1	5/8-inch rope

Some departments carry all this special equipment in a particular part of their rescue truck or ladder truck. Some even make a special container for the equipment, so it can be taken up a ladder easily and quickly.

Figure 1 (next page) shows the basic equipment. Figure 15 at the end of this chapter shows specifications for a rescue belt.



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 1

Equipment needed for aerial ladder rescues

PROCEDURE

One squadman should be in charge of the whole rescue procedure. In the case of a roof-top operation, he directs from the roof.

PREPARING THE VICTIM

Any needed first aid should be given to the victim immediately. Then he should be logrolled onto a backboard, as shown in Chapter XIII of this text. He must be strapped to the board before the ladder rescue procedure is carried out, with his feet secured to the footrest. Figure 14 in Chapter XIII shows a patient properly secured to a backboard.

USING THE LADDER

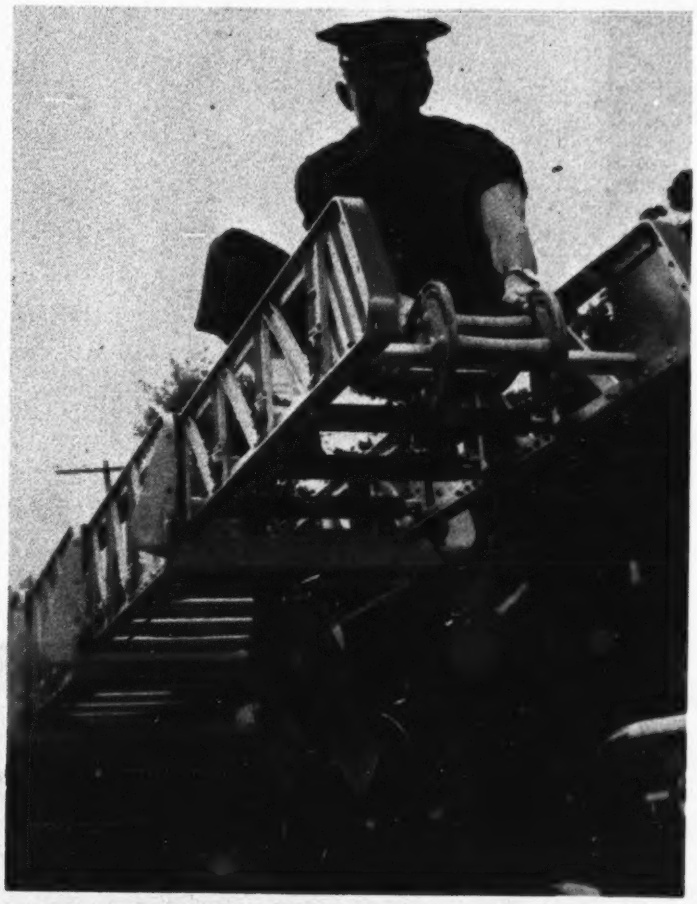
The use of an aerial ladder rescue truck for both horizontal and vertical rescues is described and pictured on the pages that follow.

When the ladder truck arrives, the turntable should be lined up with the center of the victim's body. This can be directed by a squadman who places himself where he can be seen easily by the truck driver. All obstacles such as wires, trees, etc. should be observed by both the squadman in charge on the roof and the officer in charge of the ladder truck.

As soon as the truck is positioned, the outriggers should be placed. The fly of the ladder should be extended four rungs while still in the bed.

The hose roller is then secured to the top rung of the ladder as shown in Figure 2.

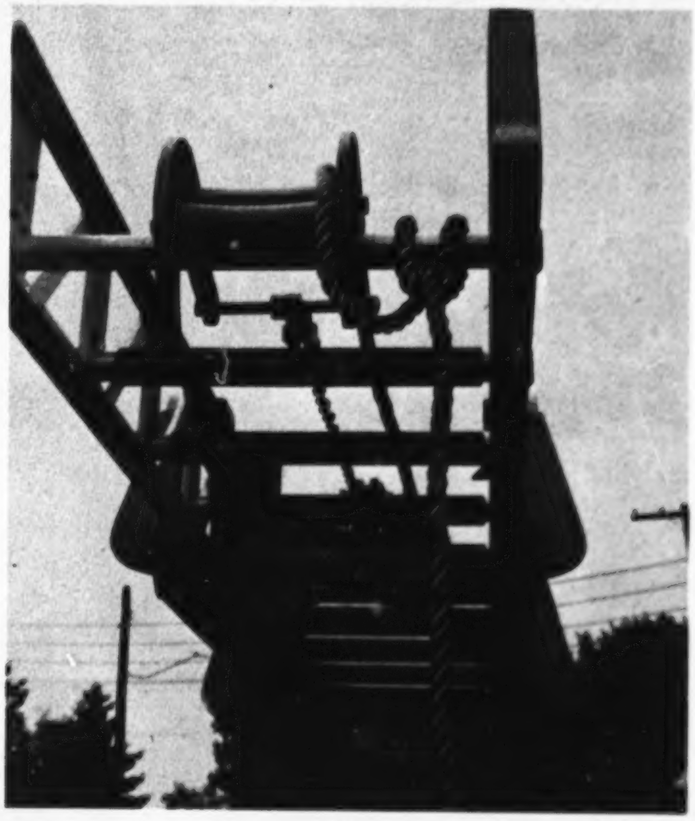
One end of the large rope is tied to the top rung of the ladder with a clove hitch. (See Figure 3.) The remainder of the rope is brought down the center of the ladder and put on the turntable or ground.



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 2

Securing a hose roller to the top rung of an aerial ladder.

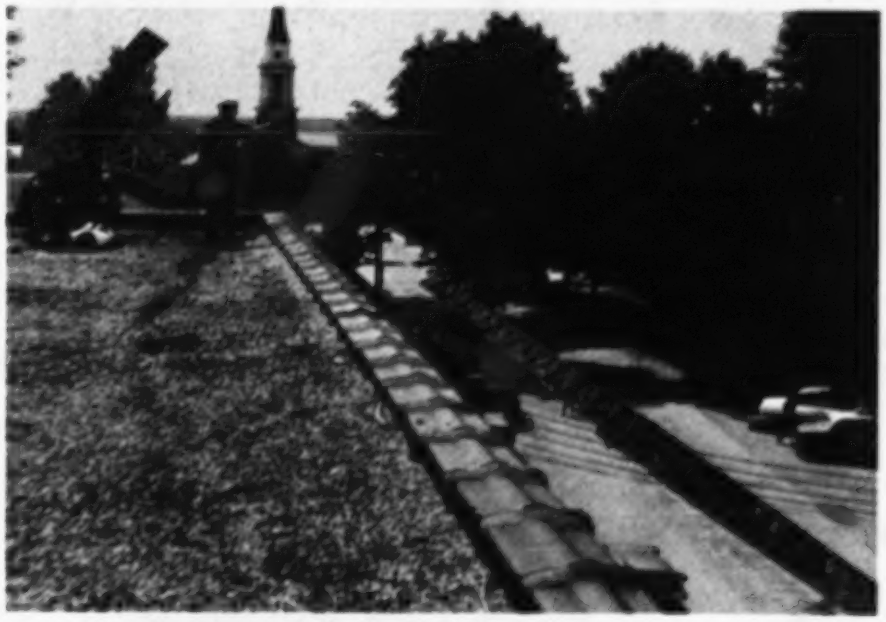


Courtesy Sharon Twp. F.D., Worthington, O.

Figure 3

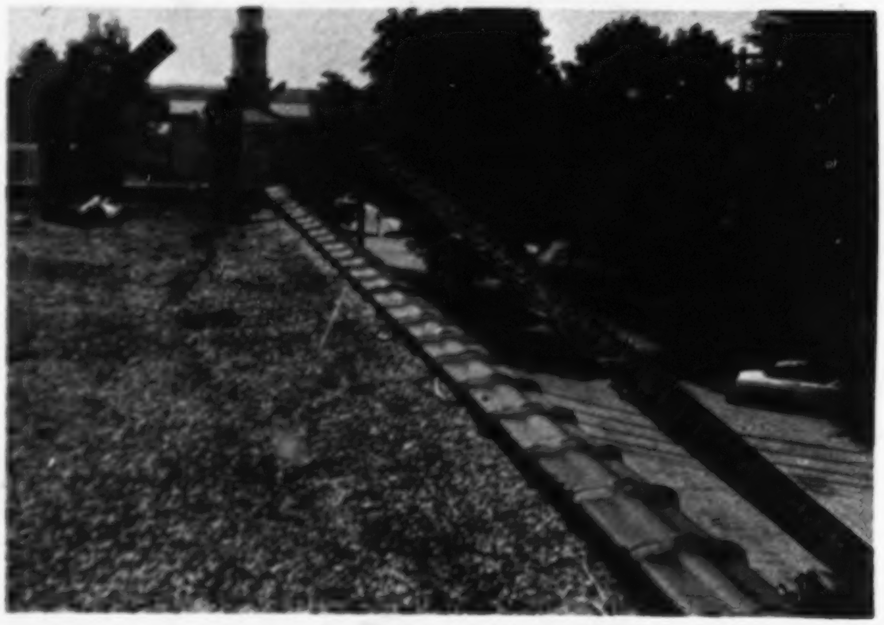
Hose roller and large rope in place on top rung.

At the direction of the man in charge (on the roof in this example) the ladder is extended to him. (See Figure 4.) The top rung of the ladder is brought directly over the victim. Meanwhile, squad members are preparing the victim on the board. (See Figure 5.)



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 4

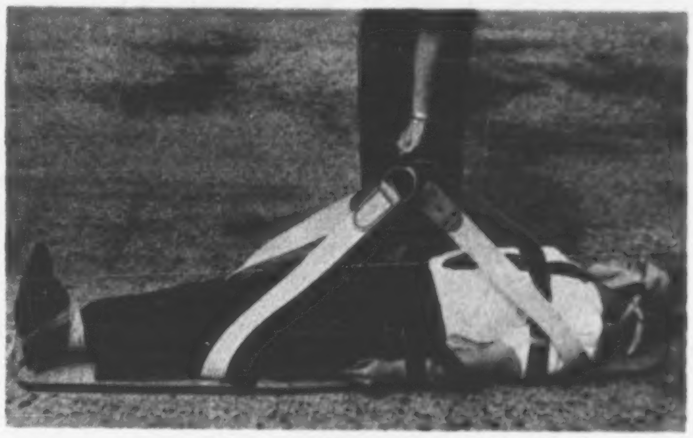


Courtesy Sharon Twp. F.D., Worthington, O.

Figure 5

The man operating the ladder cannot see the victim. He must be completely directed from above. Figure 4 shows the ladder fly as he extends it toward the man in charge. The ladder is directed up until it is positioned squarely over the middle of the victim. (See Figure 5.) Note the squadmen preparing the victim.

After the victim is secured to the board, the two large web belts are put through the top and bottom holes on the side of the board. (See Figure 6.)

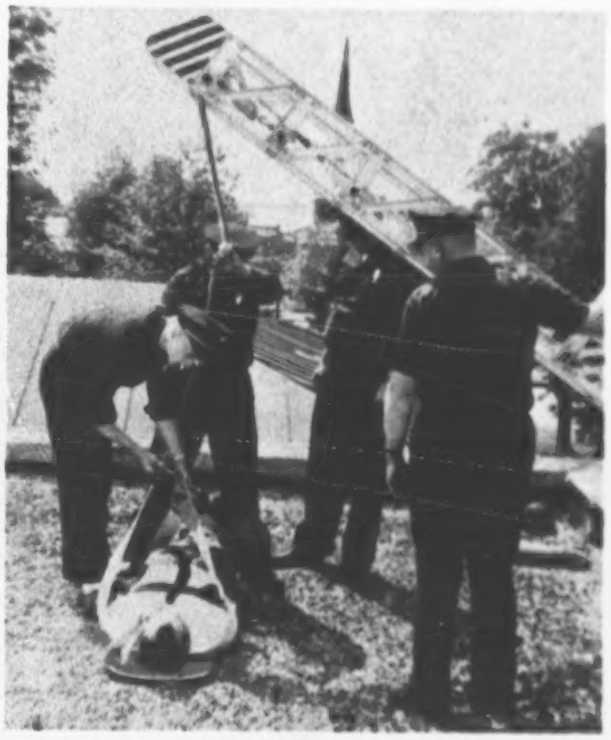


Courtesy Sharon Twp. F.D., Worthington, O.

Figure 6

Large belts in place. In order to show all straps and their placement, the victim in this posed picture was not wrapped in a blanket as he would have been in an actual rescue.

The large rope is now removed from the top rung, placed over the hose roller, and put through all four "D" rings of the large web belts. (See Figure 7.)

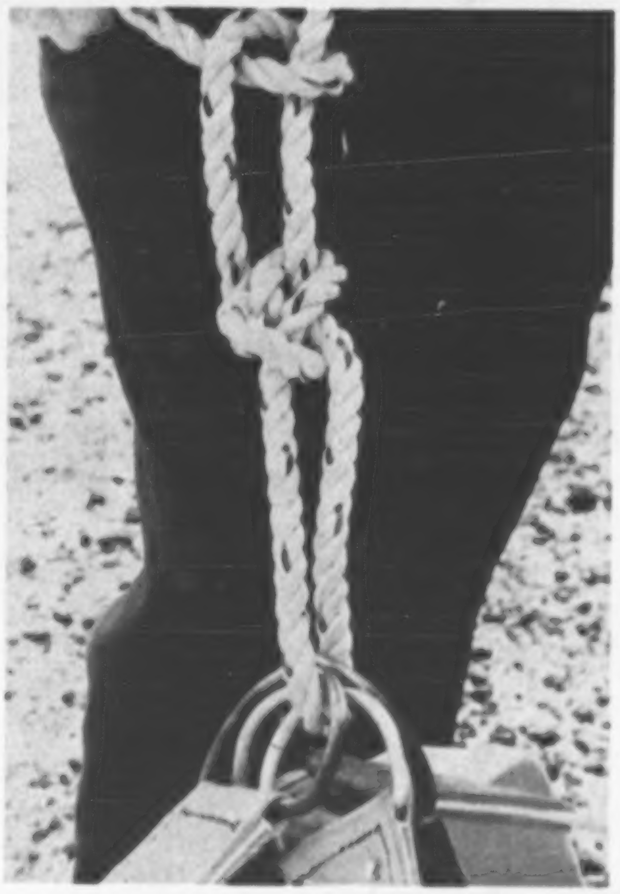


Courtesy Sharon Twp. F.D., Worthington, O.

Figure 7

Large rope placed through "D" rings.

A bowline and a half hitch are then placed in the rope. (See Figure 8.)

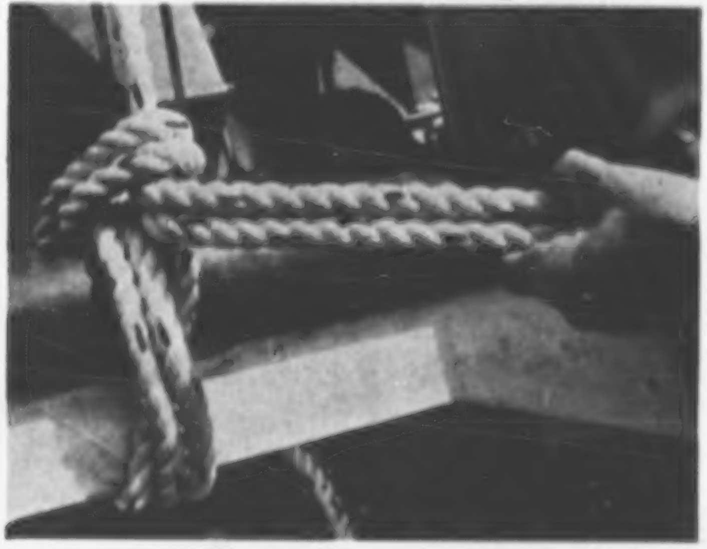


Courtesy Sharon Twp. F.D., Worthington, O.

Figure 8

Bowline and half hitch

The men of the ladder company then pull up all the slack possible and tie the rope doubled to the metal foot bar or plate at the bottom of the ladder. (See Figure 9.)



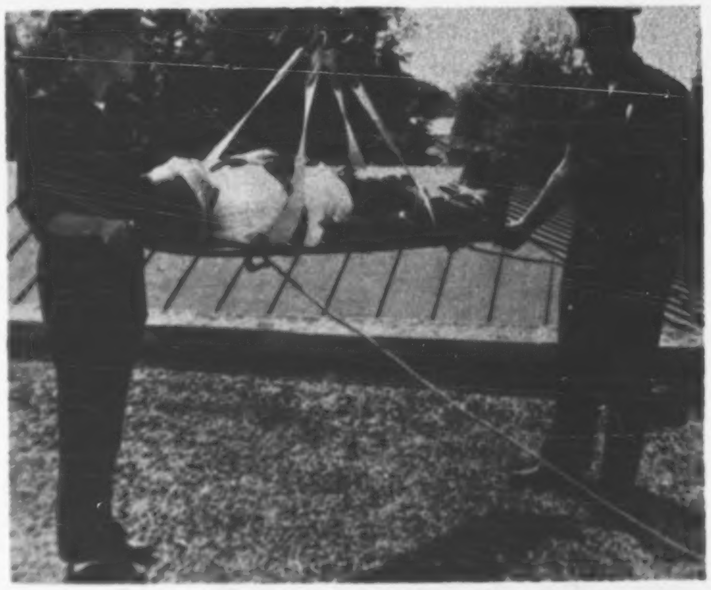
Courtesy Sharon Twp. F.D., Worthington, O.

Figure 9

Tie at bottom bar or plate

Then the fly is extended or the ladder is raised, whichever is best for the particular rescue. This is continued until the victim is lifted three to four feet from the surface. (See Figure 10.) Then the lifting procedure is stopped. This is to test all knots.

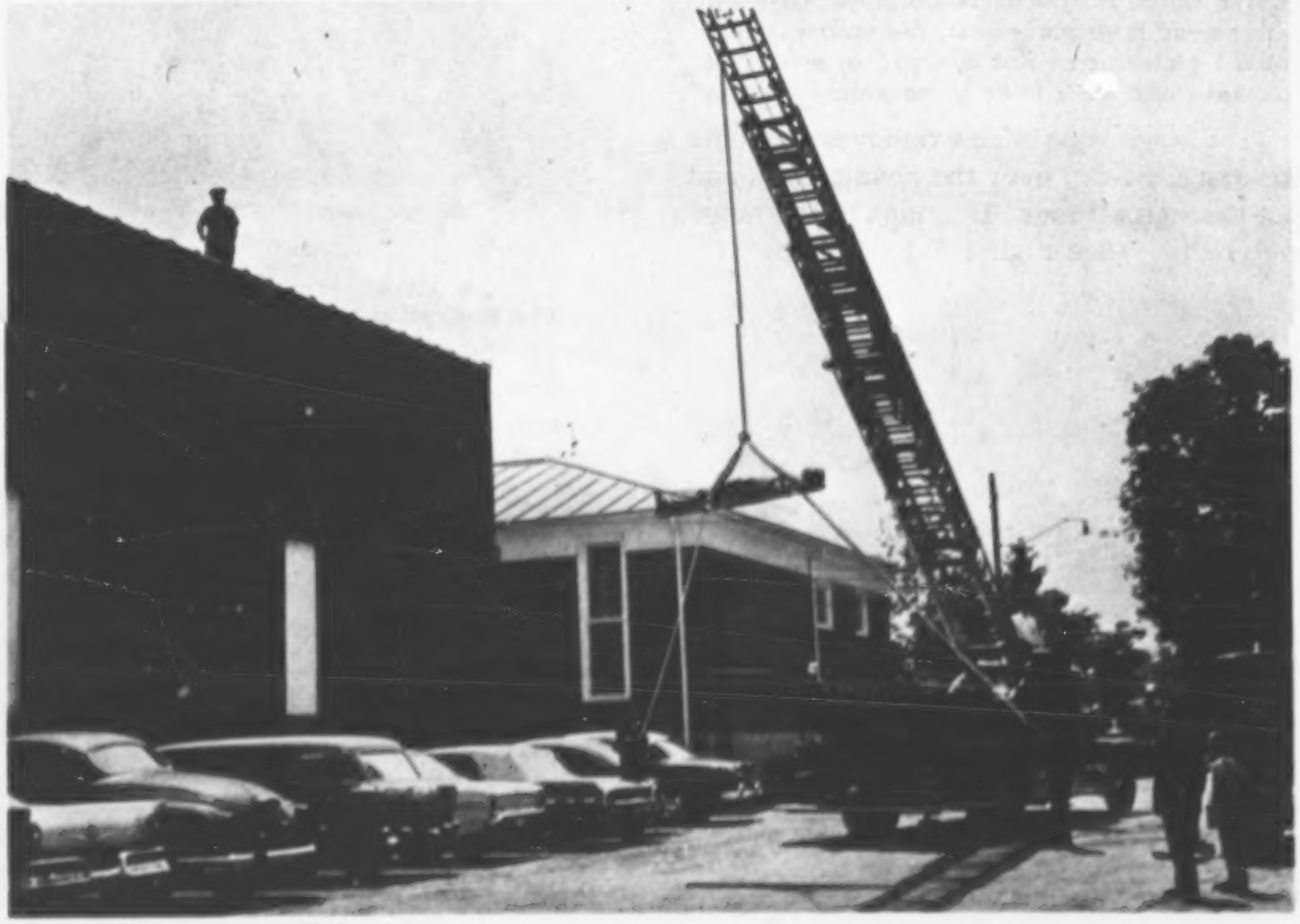
The two small ropes are put through the same holes as the large belts, and are thrown over the side of the building to two laddermen. (See Figure 10.) These ropes guide the board and prevent undue movement. The ladder is retracted or the turntable is rotated, or both, until the victim is free of the building and all obstacles. (See Figure 11.)



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 10

Testing knots and placing guide ropes

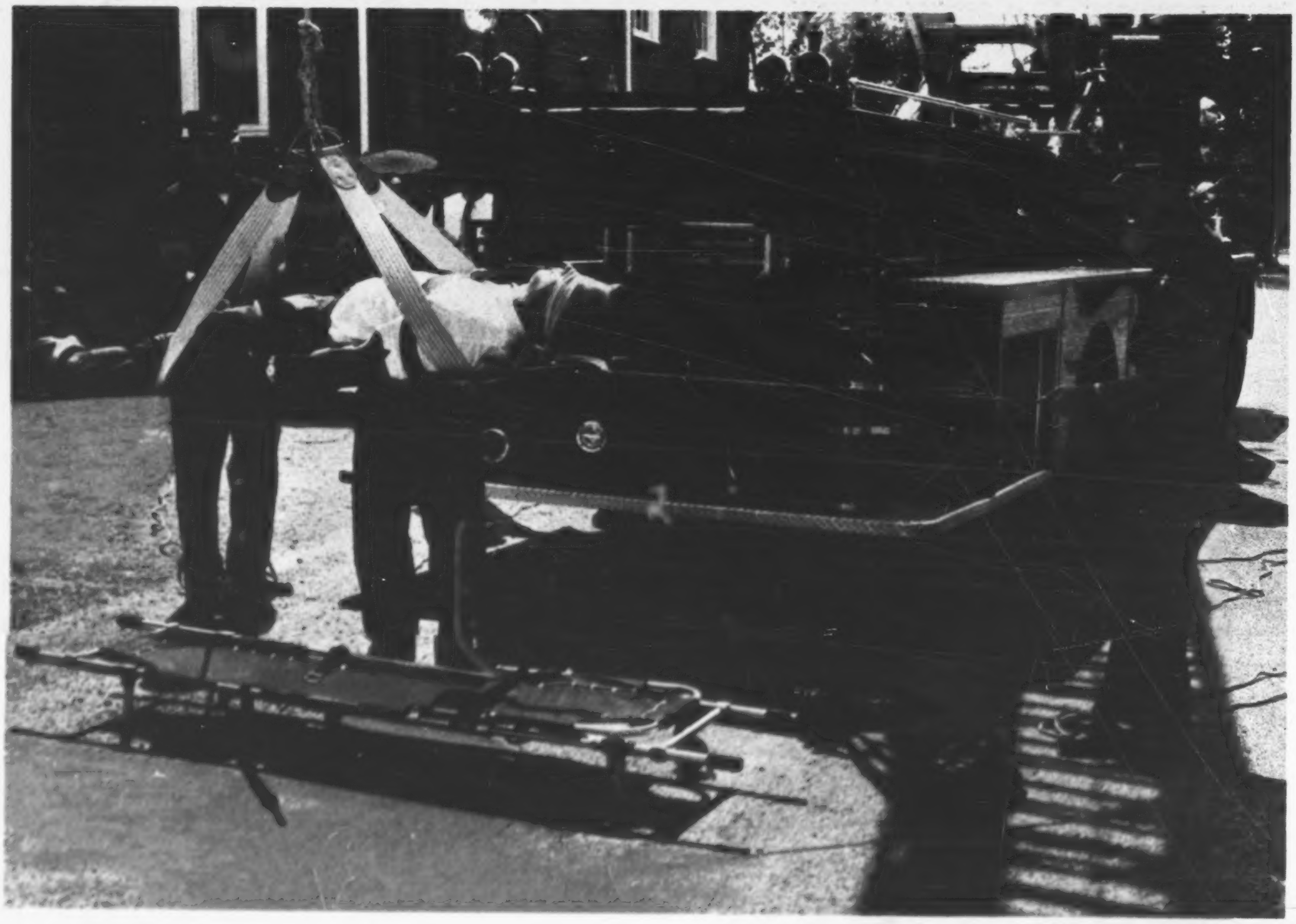


Courtesy Sharon Twp. F.D., Worthington, O.

Figure 11

Victim is lifted free of all obstacles and lowered toward the ground.

The procedure can become so smooth with practice that the stretcher can be placed on the ground and the ladder operator can deliver the victim to it. (See Figure 12.)



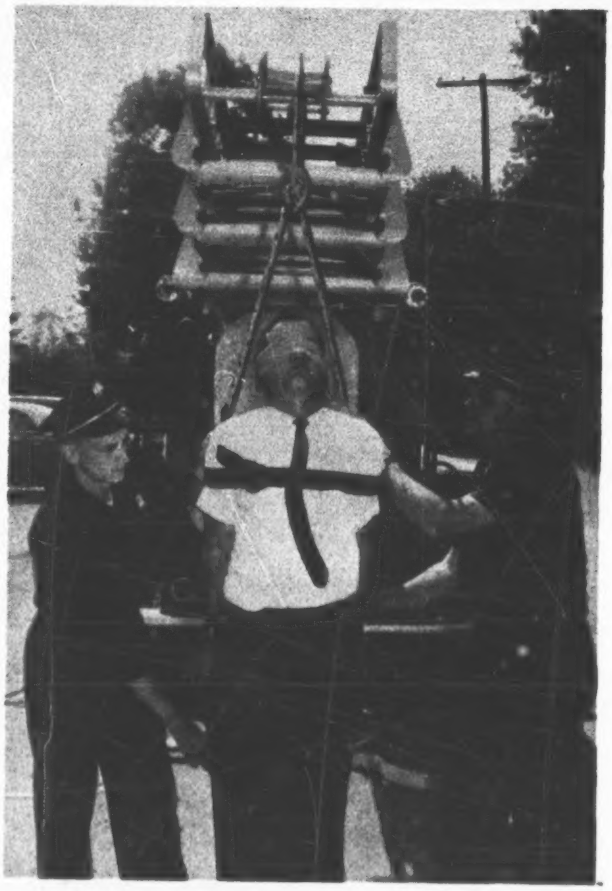
Courtesy Sharon Twp. F.D., Worthington, O.

Figure 12

Experienced rescue team lowers victim directly onto waiting stretcher.

VERTICAL RESCUE POSITION

Sometimes in an aerial ladder rescue a victim must be removed in a vertical position. In this case first aid is given and the victim is strapped to a backboard, as previously described. The ladder crew prepare as they would for a horizontal rescue procedure. The rope placement is different. After the fly is brought to a position over the victim, the large rope is put through the top two hand holes in the board. It is most important that the rope is placed with the knot to the front of the board. (See Figure 13.)

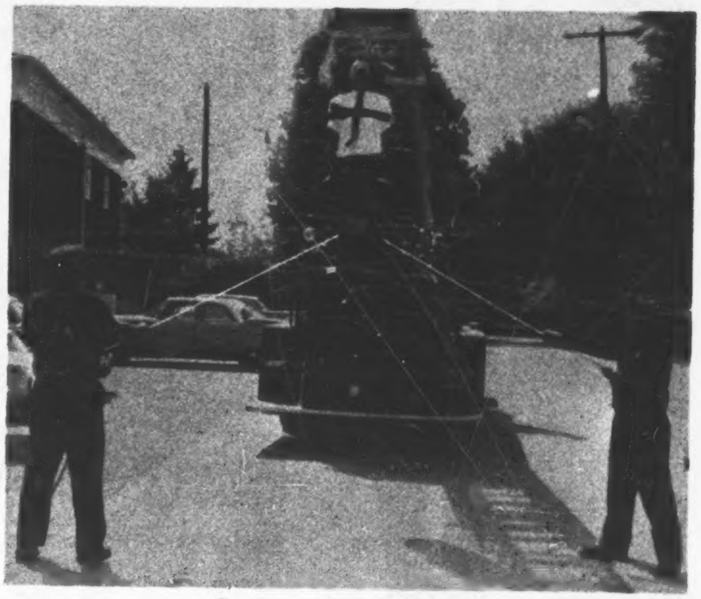


Courtesy Sharon Twp. F.D., Worthington, O.

Figure 13

Correct knotting of large rope for moving victim in vertical position

After the board is raised three to four feet off the surface, guide ropes are placed at the bottom holes of the board. The two truck men can then control the board. (See Figure 14.)



Courtesy Sharon Twp. F.D., Worthington, O.

Figure 14

Guiding descent of victim by means of ropes through bottom backboard holes

RESCUE BELT

Figure 15 shows specifications for a rescue belt that an emergency squad can make.

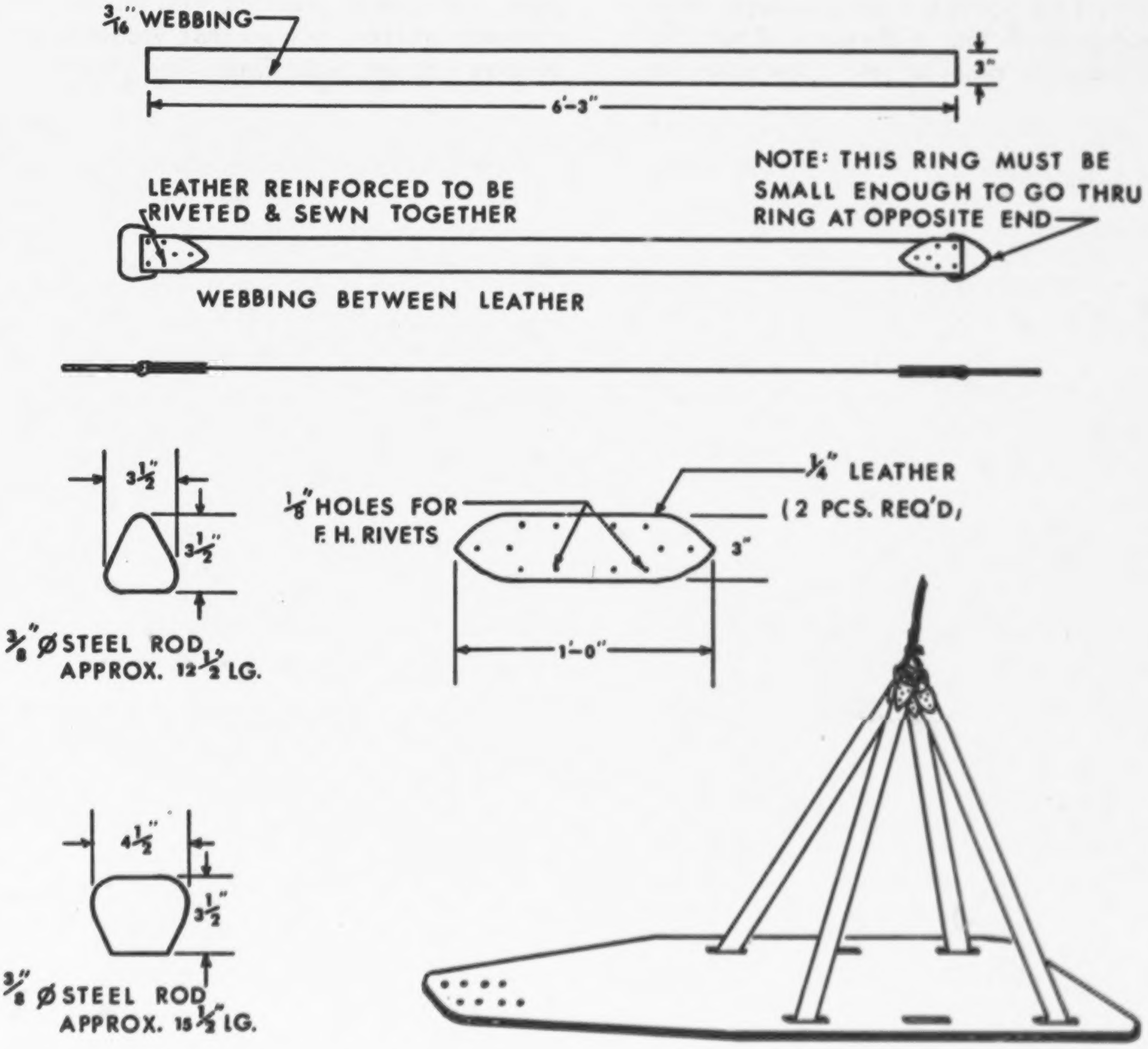

3/16" WEBBING
3"
6'-3"
NOTE: THIS RING MUST BE SMALL ENOUGH TO GO THRU RING AT OPPOSITE END
LEATHER REINFORCED TO BE RIVETED & SEWN TOGETHER
WEBBING BETWEEN LEATHER
3 1/2"
3 1/2"
3/8" Ø STEEL ROD APPROX. 12 1/2" LG.
1/8" HOLES FOR F. H. RIVETS
1/4" LEATHER (2 PCS. REQ'D)
3"
1'-0"
4 1/2"
3 1/2"
3/8" Ø STEEL ROD APPROX. 15 1/2" LG.

Figure 15

Rescue belt

PRACTICE

Both these procedures must be practiced often. Your squad and ladder companies can become proficient to the point of being able to complete them in just a few moments.

If your squad does not have a ladder company, you should practice with the ladder company nearest you so that victims will receive prompt, safe care.

CHAPTER XVI

FORCIBLE ENTRY

INTRODUCTION

Squadmen must have means of getting into a building that is closed and locked. Admission sometimes must be gained by forcible entry. A building is entered forcibly only when all accessible doors and windows are locked and it is impossible to enter the building through normal means. This chapter explains the different methods of forcible entry and the ways of using the tools of the rescue squad in making a forced entry. The knowledge of how to use them is invaluable when the squadmen, upon arrival, find the normal entrance into the building either blocked or locked. Efficient methods of forcible entry can save property, reduce hazards to life, and create good public relations. Forcible entry tools are a "must" for every emergency or rescue squad.

MAKING ENTRY BY BREAKING GLASS

Glass in either a door or window may be broken easily by using the flat side of a fire axe. The man breaking the glass should stand to one side and strike the upper part of the glass first, as shown in Figure 1. In this way, broken glass cannot slide down the axe handle and cut the hands.

After the glass is broken out, all jagged pieces should be removed from the sash starting at the top to avoid injury. This may be done with the pick end of the axe. Removing all pieces will avoid cutting the man who enters through the sash and will prevent damage to hose, ropes or other material that may be passed through the opening. This procedure is recommended where any difficulty is encountered in opening windows, whether in a factory, residence, or commercial building. When encountering wire glass, cut at the edge of the sash with the cutting edge of the axe.

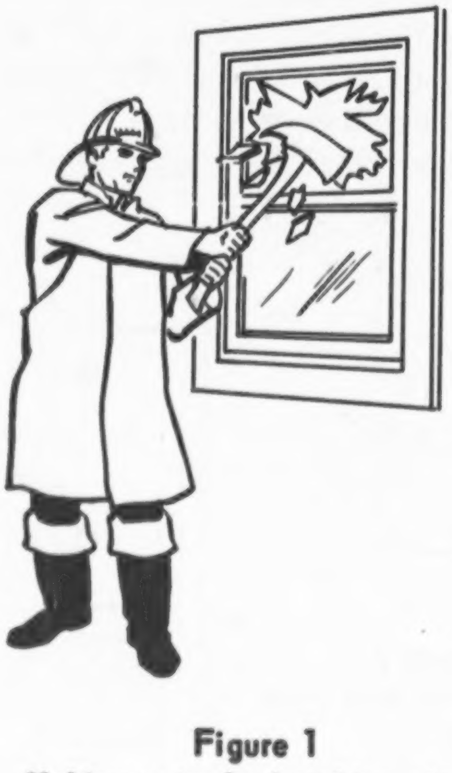


Figure 1
Making entry by breaking glass

MAKING ENTRY THROUGH VARIOUS TYPE OF DOORS

Doors are constructed of various materials and are of various types. Examples of some types are the ledge panel, slab, double sliding, single sliding, overhead lift, overhead roll and revolving doors.

Some types of steel doors offer great resistance to forcible entry. Every squad should know, by previous inspections, where these types of doors are located; the men should be instructed as to how to open them. It is often advisable to find other means of entry if possible. It should be emphasized that in gaining entrance, glass is the most easily broken material and, in most cases, the most easily replaced.

Single-hinged doors that open out may be opened from the swing side with an axe, as shown in Figure 2. The blade of the axe is inserted between the jamb and the door, just above or below the lock. By prying with the handle to one side away from the door, the jamb can usually be sprung enough to let the lock bolt pass under the keeper. The Kelly tool may also be used for this purpose (Figure 3). The Buster bar or Hux bar may be used for prying open a door in a manner similar to the Kelly tool. Either the straight or the cross head of this tool may be used where a door is near a partition, permitting a better leverage with the tool.

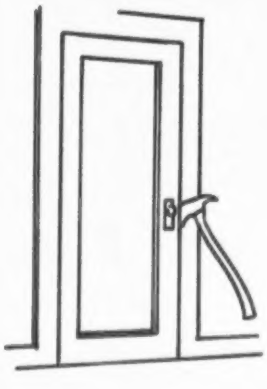


Figure 2
Opening door with axe

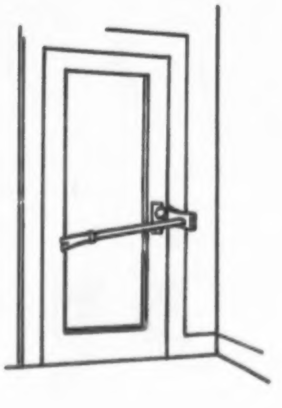


Figure 3
Opening door with Kelly tool

In opening a door that swings in from the operator, greater difficulties are presented. If the door is in a stopped frame, the straight head of the Kelly tool may be inserted between the door and the jamb (Figure 4). Then prying toward the door should spring it past the lock bolt.

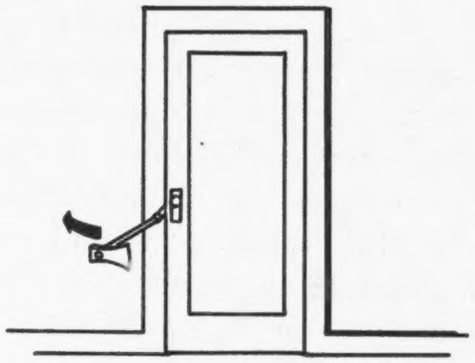


Figure 4
Kelly tool used for door that swings in

If the door is in a rabbeted frame, there is little chance of springing the frame. The cross head of the Kelly tool may be inserted between the door and the jamb as shown in Figure 5; prying against the door will break the door, the jamb or the lock. If the door has glass in it, it is better to break the glass and manipulate the lock from the inside.

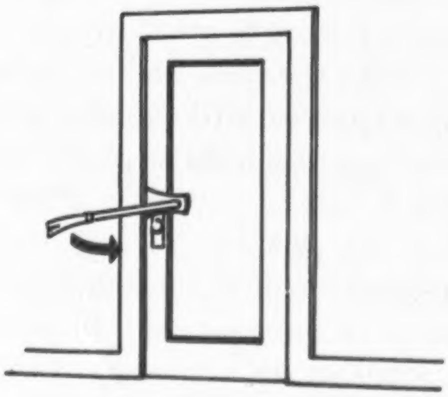


Figure 5
Kelly tool used for rabbeted jamb

The Detroit door opener may be used for forcing doors in, as shown in Figure 6, by either breaking the door or spreading the jambs. Double-hinged doors may be opened either with an axe or with the Kelly tool, as shown in Figure 7.

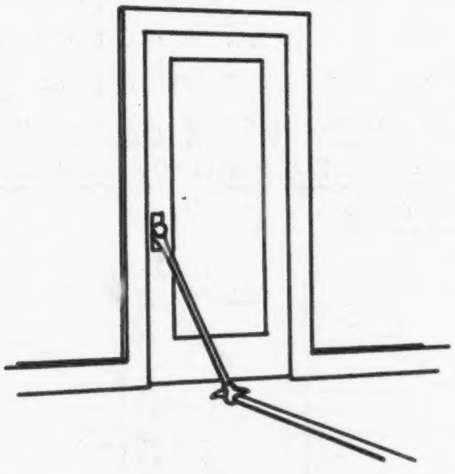


Figure 6
Using "Detroit" door opener

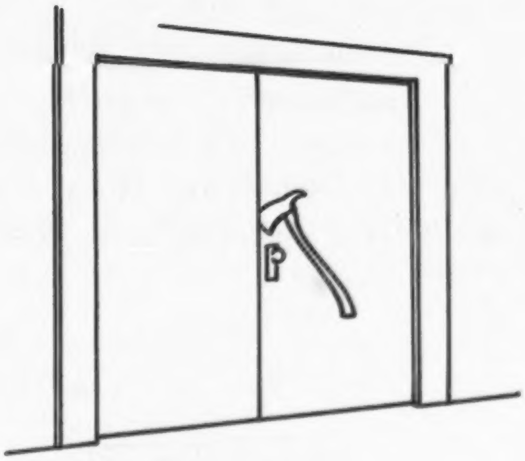


Figure 7
Opening double-hinged doors

Single-hinged doors on warehouses, stables and other building may be locked with a hasp and padlock. If so, the staple of the hasp may be pried or twisted off with a claw tool such as shown in Figure 8. The point of the claw is inserted in the staple end and if a pry will not remove it, it may be twisted off, taking the lock with it.

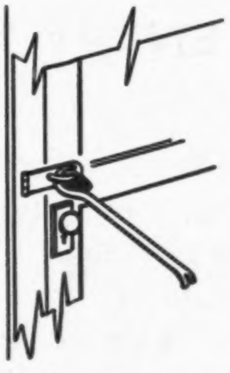


Figure 8
Prying off staple

Overhead lift doors are easily operated once the lock is released. Generally, they are locked with sliding bars that must be broken or sprung to release the door. Overhead lift doors may be forced by prying upward at the bottom of the door with a crow bar, claw tool, or other good prying tool. Once the lock bar is broken, the door will open easily. Overhead rolling doors are made of steel and offer the greatest resistance of all to forcible entry. Since an overhead door is operated with a worm gear, the door cannot be raised except by operating the worm with the chain which is provided. Prying the door is liable to spring it so that it cannot be operated even with the worm gear. The only alternative is to knock out bricks along side of the door, making a hole large enough to operate the chain.

If doors are locked so securely that no other method of forcing them is successful, they should be battered in. This may be done with a battering ram. Use the blunt end of the ram and see that it strikes just below the lock, on the rail or solid portion of the door.

The only means of forcible entry through a solid glass door is a sharp pointed tool, such as an axe point. Using this point, hit the lower corner of the door a hard blow. This will cause the door to shatter and permit entry. Caution must be taken to protect the eyes and other exposed portions of the body from the shattering glass. It is a good practice to back up to the door.

MAKING ENTRY THROUGH VARIOUS TYPES OF WINDOWS

Residence windows are of these general types: sliding, awning type, double hung, casement and basement. The double hung window consists of two sashes that meet horizontally. If the sashes are hung with weights, they will be locked at the center of the check rail; that is, the upper and lower sash will be locked together. If the window has no weights, the sash will be locked with bolts in the window sill.

Casement sash are hinged to the window jambs and meet vertically. They are either locked together or each is locked to the window frame. Basement sash generally are hinged at the top and locked at the bottom, or vice versa. Factory-type windows are generally constructed with metal sash. The sash is set solidly in the frame and only part of it may be opened (Figure 9). The movable part is generally pivoted at the center and latched on the inside.

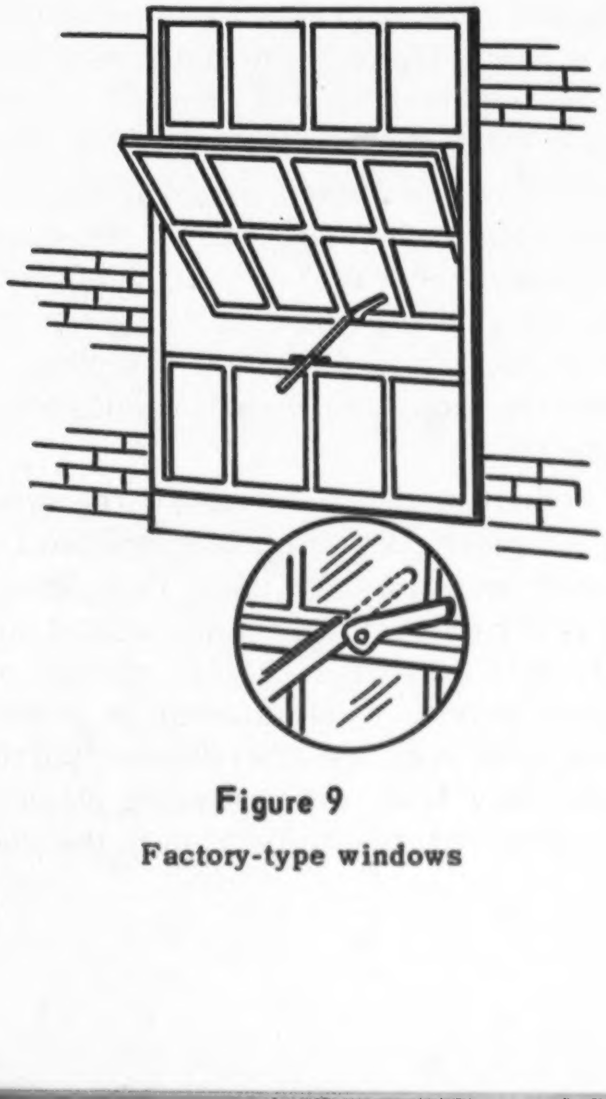


Figure 9

Factory-type windows

Double-hung windows may be opened by prying upward on the lower sash rail. See Figure 10. If they are locked on the check rail, the screws of the lock will give and the sash will operate. If they are locked with bolts, the bolts must be broken or bent before the sash will rise. Caution should be taken that the prying is done at the center of the sash, or else the glass may be broken.

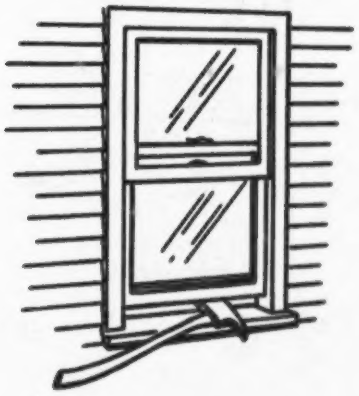


Figure 10

Opening double-hung windows

Casement windows may be opened in the same manner as double doors. See Figure 11. Generally, they are locked quite securely and it may be necessary to break the glass.

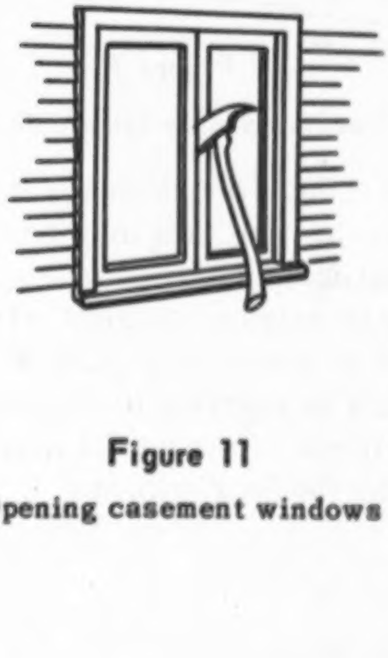


Figure 11

Opening casement windows

Casement windows may be opened with a Kelly tool, much the same as a door in a rabbeted frame. If the prying is done at the center of the lower rail, the lock may be pulled off or sprung. Any of the prying tools such as the Buster Bar or Hux Bar may be used. Chisels, spanners, etc., can be used for prying in this same manner.

FACTORY WINDOWS

It is practically impossible to open factory-type windows from the outside and, since they are glazed with small size glass, it is easier and less destructive to break a glass near the latch and reach in to unfasten it.

STORM DOORS AND STORM WINDOWS

There has been much discussion on the proper procedure to follow when encountering locked storm doors and windows. The wooden doors or windows, in most instances, can be pried open without too much difficulty and little or no damage to the wood itself. When encountering metal storm doors or windows, the general procedure is to break the glass to open the locked door or window. In this instance, remember to remove the broken glass from the frame before putting the hand through to unlock the door or window. It is not recommended that the metal storm door or window be pried open because of the costly damage to the metal framing.

MAKING ENTRY FROM ROOF

Quite often this means of entry becomes necessary. If the roof covering is of tin, the rotating or can-opener type of roof cutter is used. After the metal has been cut and rolled back, the squadman proceeds with his cutting of roof boards to gain entrance. Tar paper, tar and/or gravel should be removed before the cutting procedure. Any hole, whether it be in a floor, roof or wall, should be cut properly --- as though it had been done by a mechanic --- by a squadman who knows how to do the job.

When cutting with a fire axe, the axe should not be swung as a wood cutter would use it, but with short quick strokes. Figure 12 shows the method of holding the axe when cutting. By using this method, danger of hitting other men, catching the axe in overhead obstructions, and other such hazards will be avoided and the axe will be under complete control at all times.

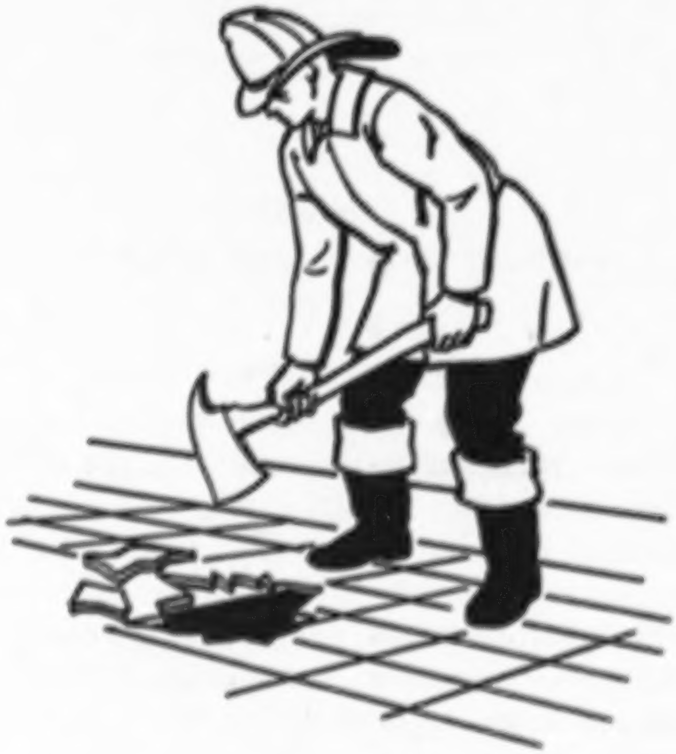


Figure 12
Holding the axe to cut floor hole

When cutting flooring, roofing or sheathing, the cut should be made diagonally to the grain of the wood of each board, rather than straight across. Figure 13 shows the method to use.

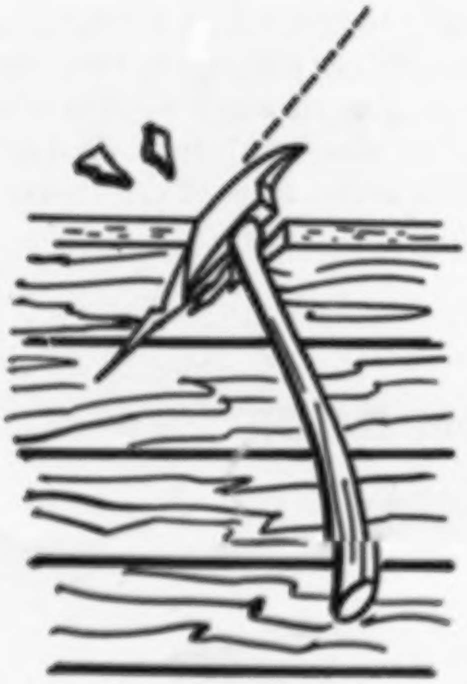


Figure 13
Cutting across wood grain diagonally

Diagonal sheathing should be cut when possible in the direction toward which it runs. When cut in this manner, the chips have a tendency to split out, while if the cutting is done across the grain of the sheathing, the axe is apt to bind and extra effort will be required to achieve results. Wherever possible, the cutting should be sloped at an angle of 45° to the board instead of vertically. This will provide a firmer base to cut against. Also, cut as close to a joist or rafter as possible.

In cutting roof boards always stand on the windward side of the boards to be cut, then cut along the inside edge of the roof rafter. In cutting holes to a size wider than one span of rafters, the center rafter or rafters will hold the boards in place until all cuts are completed. All cutting must be completed before any boards are removed. When the cutting has been completed, again standing on the windward side, use the pick end of the axe or pike pole to rip up the boards, starting at a point farthest away from you.

A squadman should be able to cut either right- or left-handed. Cutting in difficult corners and under obstructions can be done in a workmanlike manner by men who have been trained in the proper way to use a fire axe. Good axes and good axemen are important to efficient squad operations.

In some cases a pike pole may be needed to remove plaster and lath from the ceiling below the place at which the hole has been cut in the roof. (Figure 14).

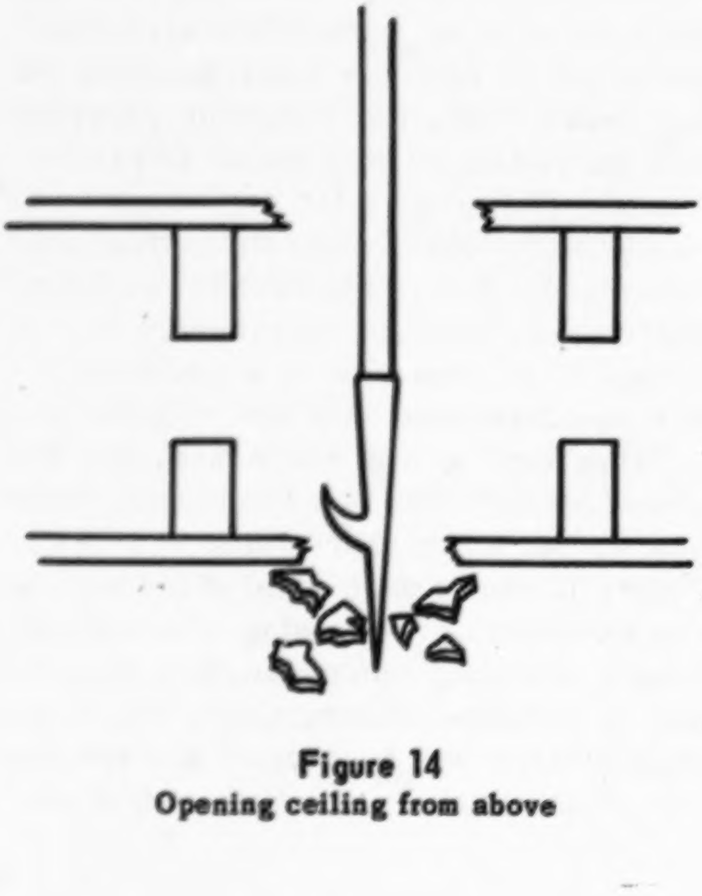


Figure 14
Opening ceiling from above

MAKING ENTRY THROUGH SKYLIGHT, COCK LOFT, OR SCUTTLE HOLE COVER

In making forcible entry through a skylight a pick-headed axe is often used. The point is placed beneath the edge of the frame (Figure 15). Prying action produced by pulling on the axe handle exerts pressure to raise the edge of the frame. If the skylight is not raised readily, it is advisable to break the glass, remove broken glass, reach inside, and release hooks or bolts. For removal of cock loft cover or scuttle hole cover, the same prying procedure is used. If the cover does not remove readily, it must then be cut open by use of the cutting edge of the axe.

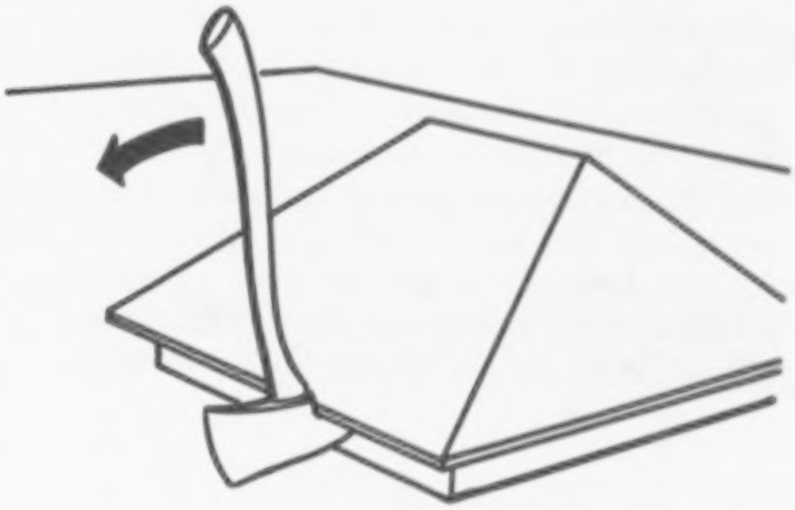


Figure 15
Making entry through a skylight

MAKING ENTRY THROUGH GRATINGS, DEAD LIGHTS, AND BARRED WINDOWS

Iron gratings may be fastened in several different ways. They may be merely held in position by friction of the grating against the sill or they may be pivoted on hinges at the rear. They may also be set in masonry and locked in position with hasp and padlock. They may be opened by using the pick end of the axe, forcing it between the sill and the grating and prying up, care being exercised not to break the axe handle.

Dead lights are placed in sidewalks under which basements extend. They serve both as a sidewalk and as a ceiling for that part of the basement. They contain heavy glass discs which permit light to enter and are sealed into a steel framework with waterproof material. The steel framework is likewise sealed into the concrete, and to remove the dead light the seal must be broken. Any good, sharp prying tool may be used for this purpose. After the seal is broken the dead light may be lifted and removed.

Iron bars on windows are usually set in masonry. The sledge hammer can be used to free bars set in masonry by striking the bar with the sledge about ten inches above the sill until the bar is sufficiently bent for removal. Another method is to strike the masonry sill with the sledge directly in front of the bar, breaking away the masonry.

MAKING ENTRY BY BREACHING WALLS

To breach brick walls with the battering ram, (Figure 16), first remove one brick with the hammer head pick, pick-headed axe, sledge or other suitable tool. After the first brick has been removed, two men grasp the handles on each side of the ram. with the forked end toward the wall. They swing the ram back at arm's length, then quickly thrust it against the wall, giving it a slight lifting motion just as it strikes the brick. Remove the bricks one at a time, starting just below where the first brick was removed. The hole should be made diamond-shaped as this does not weaken the wall.

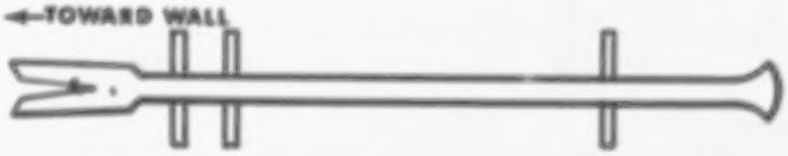


Figure 16
Battering ram

MAKING ENTRY THROUGH OPENINGS IN PARTITIONS AND CEILINGS

When cutting a hole in a partition, care should be taken to make it as neat as possible. Spread a tarpaulin on the floor beneath the place where the hole is to be made; then, with the blade of an axe, cut down along the stud. Do not tear off the lath, as this will make a ragged edge and ruin the plaster on both sides of the hole. See Figure 17.

Figure 17A
Cutting through partition walls: correct method

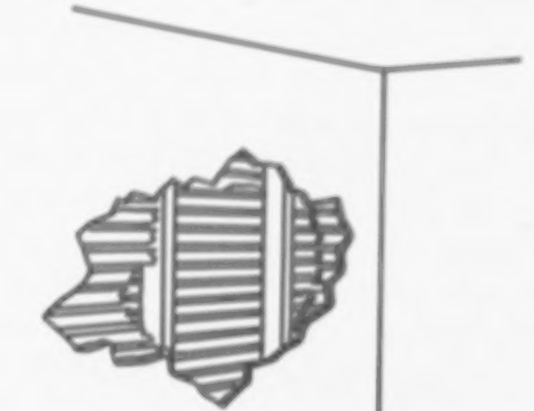


Figure 17B
Incorrect method

To open ceilings from below, the pike pole or the plaster hook (Figure 18) is used.

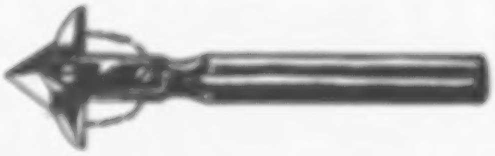


Figure 18
Plaster hook

When pulling down lath and plaster from ceilings and walls with a pike pole, never stand directly beneath the hook after the point and hook have been driven through the plaster. The hook on the pike pole should be pointed down and away from the squadman while pulling down the ceiling. This will prevent the lath and plaster from falling on the squadman. See Figure 19.

When metal lath has been used in the construction of a room or office, the operation of pulling down the plaster with a pike pole is often extremely hazardous. The metal lath is usually suspended from the rafter by means of soft iron wire, and when a portion of the plaster is pulled with the pike pole, the weight of the plaster will often cause a whole section, or sometimes several sections, to drop. For this reason it is important that a squadman, when pulling plaster from a ceiling known to be plastered on metal lath, be close to an open door or window that will enable a hasty, unobstructed retreat from the room if necessary. Several cases of injury have occurred because this precaution was not observed.

In pulling down metal ceilings, the pike pole is particularly effective. The point is driven through the ceiling with the hook pointing downward and the operator standing well away from beneath the section of metal to be torn down (Figure 20).

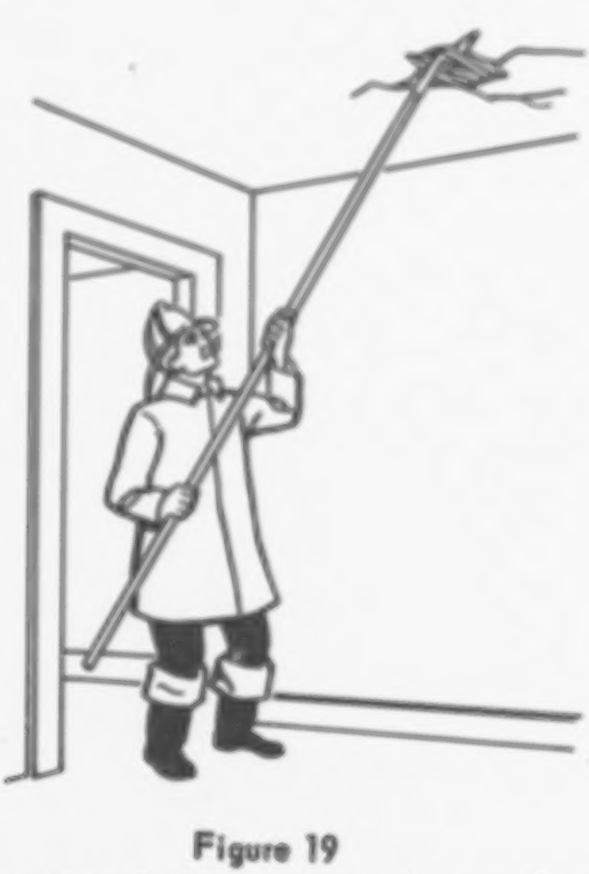


Figure 19
Pulling down lath and plaster from ceiling with pike pole

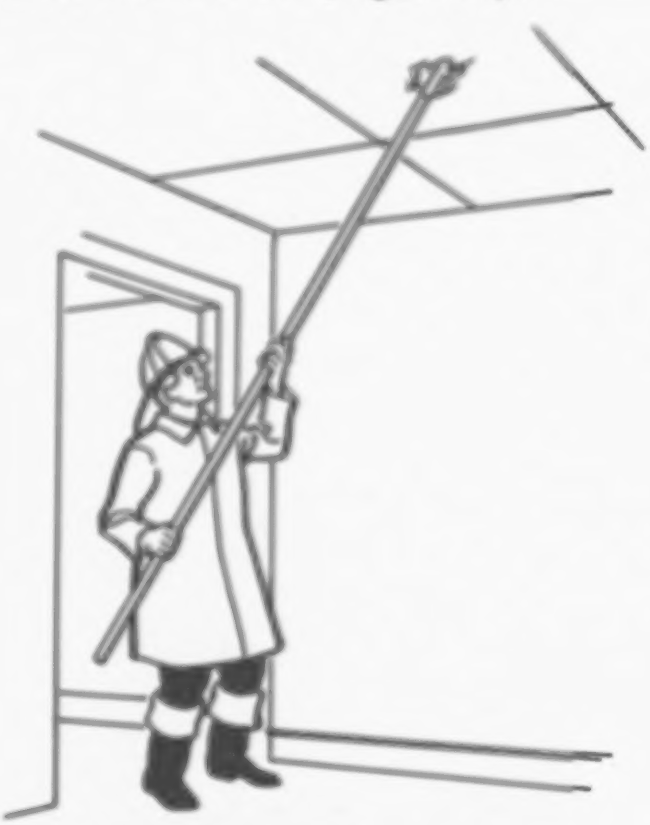


Figure 20
Pulling down metal ceiling: the pike pole can be used like a can opener to cut through sheet metal

When removing sheet metal from a ceiling with a pike pole, if the metal holds tight, the hook part of the pole can be used as the fulcrum for prying the metal loose. The same principle can be applied in removing sheet metal from roofs.

The point of a pick-headed axe or a hammer-headed pick can also be used for pulling off lath and plaster from walls in an emergency.

CHAPTER XVII

GAS MASKS

INTRODUCTION

Although a gas mask is not the most commonly used piece of equipment carried on an emergency vehicle, it can without reservation be considered the most important. Too often the life of a rescuer has been sacrificed in an effort to rescue someone trapped or overcome in a gas-filled area because the rescuer did not protect his respiratory system while attempting the rescue. In this modern age of chemicals, plastics, refrigerants, industrial processes, and developments, protecting those who must operate in these atmospheres during emergencies is a fundamental duty.

It would be impossible to list or discuss every hazardous gas encountered today. A few of the most common with which the squadman may come in contact are described in chart form on the following pages. (See Figure 1.) This chart indicates certain properties, characteristics, effects, and treatment with which the squadman should become familiar.

In addition to the hazard caused by a poisonous gas, squadmen must be aware of the possible explosion hazard. If there is doubt as to whether or not the gas involved is explosive, every precaution must be taken to prevent a spark. Light switches should not be turned on or off. Equipment or tools made of ferrous metals should be handled so as not to make sparks.

It is suggested that emergency squad personnel survey the industrial, manufacturing, and commercial areas of their community, to determine whether any additional hazardous gases may be encountered.

In cooperation with the chemists, engineers, or other responsible persons in charge of these operations, a supplementary chart can be prepared and used for reference. This is an excellent way to gain good public relations with the people in your community. They will be pleased to help when they learn of your interest in their safety and welfare.

Section 3737.31 of the Ohio Revised Code requires self-contained oxygen breathing apparatus in each fire department operated by a political subdivision. The applicable section of the law is reproduced below:

(A) "Gas mask" means any self-contained oxygen breathing apparatus using oxygen or air in suitable containers that enable their wearers to live in atmosphere containing less than sixteen percent oxygen and poisonous gases in excess of two percent by volume and having been approved by the United States Bureau of Mines for use in irrespirable atmosphere.

(B) Every political subdivision which operates a fire department shall provide at least two gas masks for each fire station and shall further provide that the chief of the fire department give adequate instructions to each member of the fire department in the use of such gas masks.

GAS AND RADIATION HAZARDS

One of the fundamental rules of squad work should be that no one, unless equipped with self-contained or self-generating air supplying apparatus, be allowed in an involved area. The ordinary filter-type mask will stop the passage of toxic fire gases such as ammonia or carbon monoxide not exceeding 2% by volume, but the masks are definitely not suitable for conditions where a deficiency of oxygen exists.

Providing for the life and safety of squadmen should be a paramount responsibility of the officers in charge. In addition to the duty of training the men in the use of respiratory equipment, the officers should see that squadmen use this equipment whenever and wherever necessary.

In recent years, another hazard has been added to the problem; that is, the use of atomic energy in the various areas of our industrial, commercial and educational structure. It is predicted that this problem will become more and more complicated because of the widespread use of radioactive materials.

Instructions from the U.S. Atomic Energy Commission relative to radiation hazards state, "Masks should be worn from the time of arrival at the emergency where radiation contamination hazard exists, until the hazard no longer exists." Preference indicated as to the type of mask to be worn in such a situation is the self-contained unit.

POISONOUS GASES

It would be impossible to list or discuss every hazardous gas encountered today. A few of the most common with which squadmen may come in contact are shown on the chart, Figure 1. This chart indicates for each gas its specific properties, characteristics, effects, and treatments with which squadmen should become familiar.

It is suggested that squads make a survey of the community to determine any additional hazardous gases which could be encountered in industrial, mercantile or commercial areas. Then in cooperation with the chemists, engineers or other responsible persons in charge of these operations, a supplementary chart can be prepared and also used for reference. This would be an excellent method by which to gain good public relations with the people in the community. The community will be pleased to cooperate when informed that the emergency squad is interested in the community's safety and welfare.

THE EXPLOSION HAZARD

In addition to the hazard caused by a poisonous gas, squadmen must also be aware of the potential explosion hazard involving some of these gases. If in doubt as to whether or not the gas is explosive, every precaution must be taken to prevent a spark. Light switches should not be turned on or off. Equipment and tools made of ferrous metals should be handled carefully so as not to create sparks.

TYPES AND USES OF GAS MASKS

In general, respiratory protective equipment is classified as follows: (1) the filter-type canister mask, (2) mask supplied with air or oxygen from an outside source, and (3) self-contained breathing apparatus. Each of these types of masks is designed for protection of the respiratory tract. It should be kept in mind, however, that for many gases protection of the respiratory tract is not enough, since some gases may harm the body on contact. For these gases it is necessary to wear protective clothing in addition to the proper respiratory protection.

GAS	WHERE FOUND OR USED	WEIGHT COMPARED WITH AIR	VISIBLE?	ODOR	TASTE?
Acetylene	Welding shops and factories	Lighter	No	Sweet	No
Ammonia	Large cooling plants	Lighter	No	Yes	Yes
Carbon Monoxide	Result of incomplete combustion	Lighter	No	Usually not noticed	No
Chlorine	Purification plants laundries	Heavier	Yes: greenish-yellow	Pungent	Yes
Hydrogen Cyanide	Exterminating buildings	Lighter	No	Bitter almond	Yes
Hydrogen Sulphide	Cesspools	Heavier	No	Rotten eggs	Yes
Methyl Chloride	Refrigeration	Lighter	No	Yes	No
Natural and Bottled Gas	Home and industrial use	Lighter	No	Yes	No
Nitrous Oxide Fumes	Fires and electrical welding	Heavier	Yes: deep orange	Pungent	Yes
Phosgene	Dry cleaners and fires	Heavier	No	New hay	No
Sulphur Dioxide	Bleaching and fumigating	Heavier	No	Bitter	Acid

Figure 1 Poisonous gases and their properties

WILL BURN SKIN?	WILL BURN EYES?	WILL BURN THROAT?	ACTION AND EFFECT ON VICTIM	EXPLOSIVE OR FLAMMABLE?	REMOVE FROM CAUSE AND TREAT FOR-
No	No	Yes	Slow or delayed	Yes	Shortness of breath or asphyxia; shock
Yes	Yes	Yes	Quick and delayed	Yes	Shortness of breath or asphyxia; shock; eye irritation; burns
No	No	No	Quick	Yes	Shortness of breath or asphyxia; shock. Keep victim inert.
Yes	Yes	Yes	Quick and delayed	No	Shortness of breath or asphyxia; shock; eye irritation; burns
No	No	No	Quick	Yes	Shortness of breath or asphyxia; shock
No	Yes	Yes	Quick	Yes	Shortness of breath or asphyxia; shock; eye irritation
No	No	No	Slow and delayed	No	Shortness of breath or asphyxia; shock
No	No	No	Quick	Yes	Shortness of breath or asphyxia; shock
No	No	No	Slow and delayed	Yes	Shortness of breath or asphyxia; shock
No	Yes	Yes	Slow and delayed	No	Shortness of breath or asphyxia; shock; eye irritation. Keep victim inert.
No	Yes	Yes	Quick	No	Shortness of breath or asphyxia; shock

FILTER-TYPE CANISTER MASKS

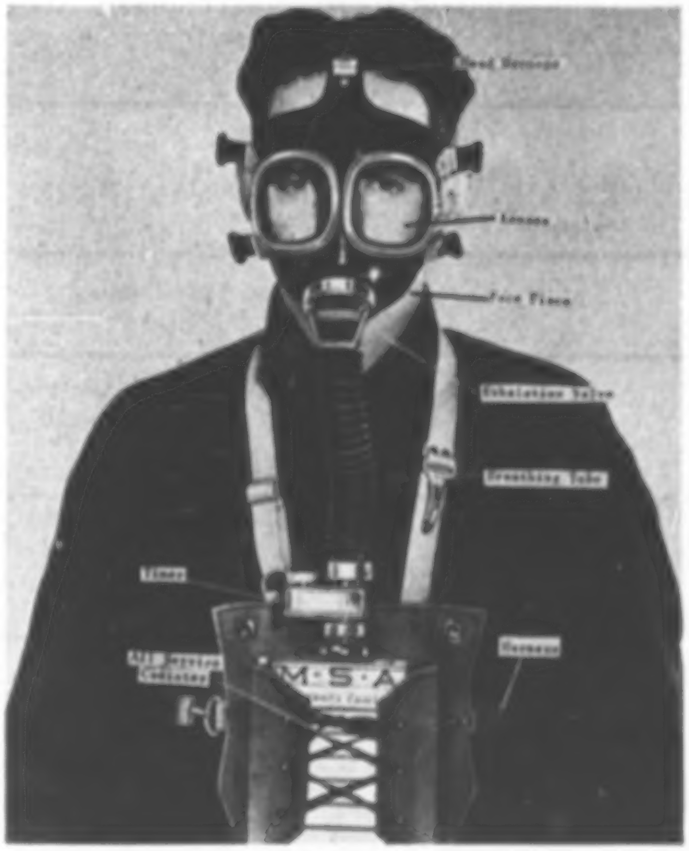
The filter-type canister mask is designed to provide protection against some kinds of smoke and poisonous gases, including carbon monoxide. Models are manufactured by several firms. It should be borne in mind, however, that all filter-type models have definite limitations. They can be worn only in atmospheres containing sufficient oxygen to support life.

The best way to detect a dangerous deficiency of oxygen is to observe the flame of a safety lamp. The flame will go out when the oxygen content of the atmosphere falls below sixteen percent. A man should not enter or remain in an atmosphere in which a flame will not burn unless he is protected by a self-contained or supplied-air or oxygen breathing apparatus. Although the use of the flame safety lamp is recommended, active combustion is an indication of sufficient oxygen to support life.

Another limitation of the filter-type masks is that they cannot be worn in atmospheres containing more than two percent by volume of poisonous gases. In addition, heavy-bodied smoke, such as that given off from burning plastic, will clog or gum the intake and interior of the canister. This causes the mask to be inoperative.

CANISTER MASK WITH TIMER

The major parts of a filter-type canister mask with a timer are: (1) the canister, with harness and carrying case; (2) the facepiece, with headbands and flexible tubing; and (3) the timer. See Figure 2.



Courtesy Mine Safety Appliances Co.

Figure 2

All-service mask

Canister - The smoke-type canister is painted red. A canister painted any other color is designed for a definite and specific group of gases. The red canister is approved for two hours of constant or intermittent use for protection from carbon monoxide. When working where carbon monoxide is present, there is a tendency for the canister to become warm. The degree of warmth will depend upon the concentration of the gas. This is due to the fact that while the chemical is acting as a catalyst in changing the carbon monoxide to carbon dioxide, heat is formed. Canisters should be stored in a cool, dry place. Seals should never be removed from a canister until it is put into service. After a canister has been put into service, it should be replaced at least once a year, even though never used.

When the mask is to be assembled, the canister is prepared for service by removing the seals. The canister can be tested by inhaling and exhaling; remember that inhalation is possible only from the top opening and exhalation into the bottom opening. An audible click will indicate that these valves are opening and closing properly.

Facepiece - The facepiece must be cleaned after wearing. The inside should be sterilized by cleaning thoroughly with a germicidal solution such as aqueous Zephiran 1:750 solution, or Staphene solution.

Headbands must be maintained in good working order. Broken or defective bands must be replaced. A facepiece with a defective band should not be used; it can not be adjusted to fit the wearer's face properly.

The flexible tubing must be examined carefully for cuts or breaks. Any impairment or defect in this tubing may jeopardize the safety and protection of the wearer.

Timer - This device indicates approximately how long the mask can be worn safely. It is actuated by the respirations of the user. The pointer rotates on a dial face. It makes a complete revolution in approximately two hours of continuous or intermittent service. After the pointer has made one complete revolution, the canister must be removed and a fresh one inserted.

The timer is connected to the canister, and the facepiece is connected to the timer. In assembling the mask, it must be made certain that the gaskets are in place at both couplings. The facepiece is then fitted to the wearer by adjusting the headbands. At this point it should be tested for airtightness by holding a hand over the opening in the bottom of the canister and inhaling. If there is no leakage the facepiece will collapse and the mask is ready for use.

In the past, the timer has been used as an indicator to show approximately two hours of breathing time. This period coincided with the Bureau of Mines requirement that the canister must contain enough drying agents to adequately protect the catalyst (Hopcalite) from water vapor during a two-hour period of use. Since the life of the canister for protection against carbon monoxide is directly related to the ability of the canister to remove water vapor, it follows that the canister will protect against carbon monoxide for a two-hour period.

Although the Bureau of Mines test for two hours of protection against water vapor is a realistic test, there are extreme conditions which will render an approved canister ineffective against water vapor absorption in less than two hours. Some of these conditions are as follows:

1. Relative humidity exposure greater than 85%, particularly at elevated temperatures.
2. Extended periods of high demand (over 25 liters per minute) of continuous breathing by a person having a large breathing capacity and performing strenuous work in atmosphere of high relative humidity.
3. Exposure of the canister to modern techniques of fire fighting where "Wet Water" and fog are used. These techniques greatly increase the amount of water vapor dispersed in the air compared with that encountered by previous techniques.
4. Accidental introduction of water into the canister by a fire hose, squadmen crawling through water on a floor, failure to completely dry the facepiece and breathing tube prior to assembling the breathing tube to the canister, or failure to replace the top and bottom seals of the canister after each use.

CANISTER MASK WITH WINDOW INDICATOR

The major parts of a window-indicator type of filter canister masks are: (1) the canister, with harness and carrying case; (2) the facepiece with headbands and flexible tubing; and (3) the check valve.

One model contains a round glass window located in the center of the canister, approximately one-third of the way down from the top of the canister. See Figure 3.

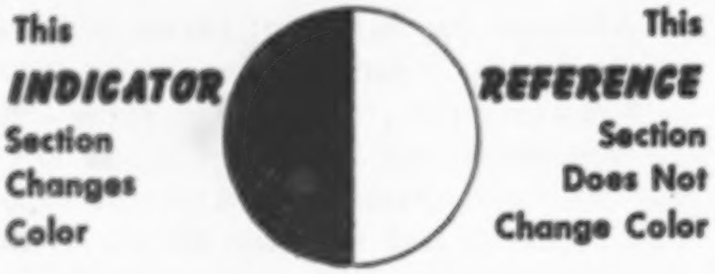


Figure 3

Indicator paper inside glass window of the canister

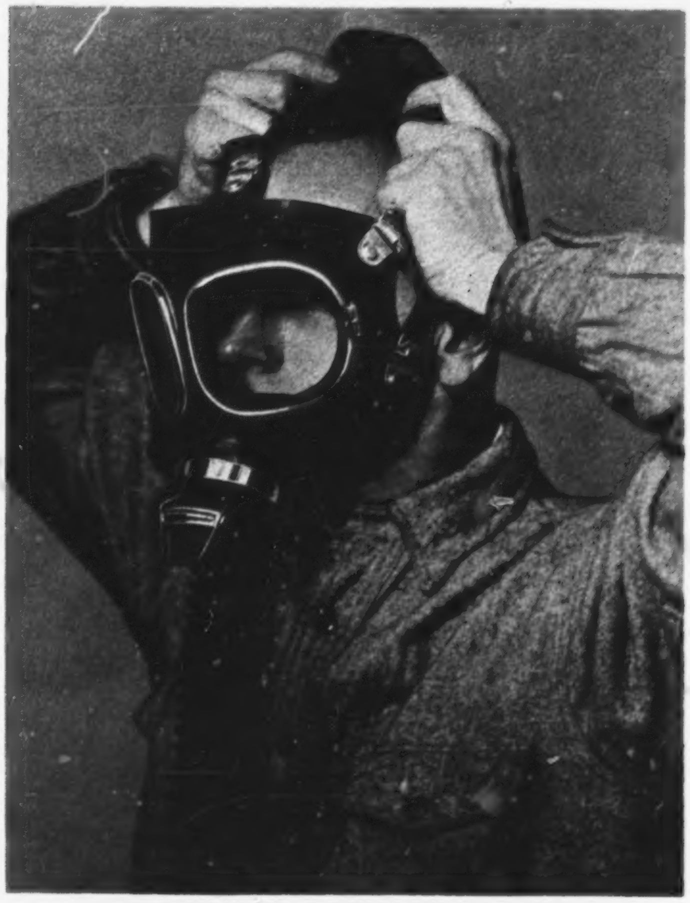
Inside the glass window are two half circles of paper. The right half, stamped "R" (facing the canister) is the reference color and is a very light blue. The left half is the indicator paper which is a darker blue. When the indicator half of the paper fades to a blue which approaches the color of the reference half, the canister is to be discarded since it will no longer effectively oxidize carbon monoxide to carbon dioxide. The color difference between the panels will exist as long as the canister has not absorbed enough water vapor to render the "Hopcalite" ineffective against carbon monoxide. Once excessive moisture has penetrated the "Hopcalite" the colors of the panels will match and the canister must be discarded. The color match should be observed under fluorescent lights or natural daylight when possible.

In the window-indicator canister a check valve fits into the assembly formerly occupied by the timer. The check valve assembly is threaded top and bottom to provide a positive attachment to the canister and the breathing tube. The valve will provide an effective seal at all times against moisture entering the canister from the top. It closes automatically after each inhalation, regardless of the position of the canister. It remains closed, regardless of the position of the mask, in storage or maintenance. The threaded fitting at the top of the valve provides for disassembly of the breathing tube and facepiece for cleaning, while the valve remains on the canister guarding it against moisture penetration from the top. If all the water is not drained from the facepiece and tube after cleaning, the valve prevents the entry of the water into the canister.

The window-indicator type of canister will more accurately indicate the actual service time than will the timer type. It is imperative that the canister be kept as free of moisture as possible to obtain maximum service life. The check-valve assembly eliminates the necessity of replacing the rubber formerly used.

PUTTING ON THE FILTER TYPE CANISTER MASK

Suspend the mask on the chest by means of the neck strap. Next, tighten the body strap so that the canister is drawn snugly against the chest. Check to make sure the headband straps are fully extended. Then grip the facepiece between thumb and fingers as illustrated in Figure 4.



Courtesy Mine Safety Appliances Co.

Figure 4

Putting on mask

Insert chin well into lower part of face-piece, and pull headbands back over the head. To obtain a firm and comfortable fit against the face at all points, adjust headbands as follows:

1. See that straps lie flat against head.
2. Tighten lower or "neck" straps.
3. Tighten the "side" straps. (Do not touch forehead or "front" straps).
4. Place both hands on headband pad and position it on the crown of the head.
5. Repeat operations 2 and 3.
6. Tighten forehead or "front" straps as needed.

PRECAUTIONS AND PRACTICES

1. Do not enter any contaminated atmosphere with this mask unless you know all of the following are true:
   a. Canister is of a filter type, Bureau of Mines approved.
   b. Concentration of the contaminants does not exceed the concentration for which the canister is approved.
   c. Amount of oxygen is sufficient; that is, at least 16% oxygen.
   d. Mask does not leak.
   e. Canister does not need replacing.
2. Register the date the canister is placed in service.
3. Keep a record on the time the mask is used.

NOTE: There is a popular misconception that filter-type canisters will afford two hours of protection against 2% concentrations of all kinds of gases; this is not true. The statement applies only to protection against carbon monoxide. The Bureau of Mines Approval Schedule #14 E requires a man-test service life of only 25 minutes in 2% concentrations of organic vapors, and only 15 minutes for 2% concentrations of acid gases or 3% concentrations of ammonia. Naturally, in lower concentrations longer life can be expected. However, the filter-type smoke canister, just like the filter-type industrial canister, must be replaced as soon as organic vapors, acid gases or ammonia penetrate the facepiece and are detected by the senses.

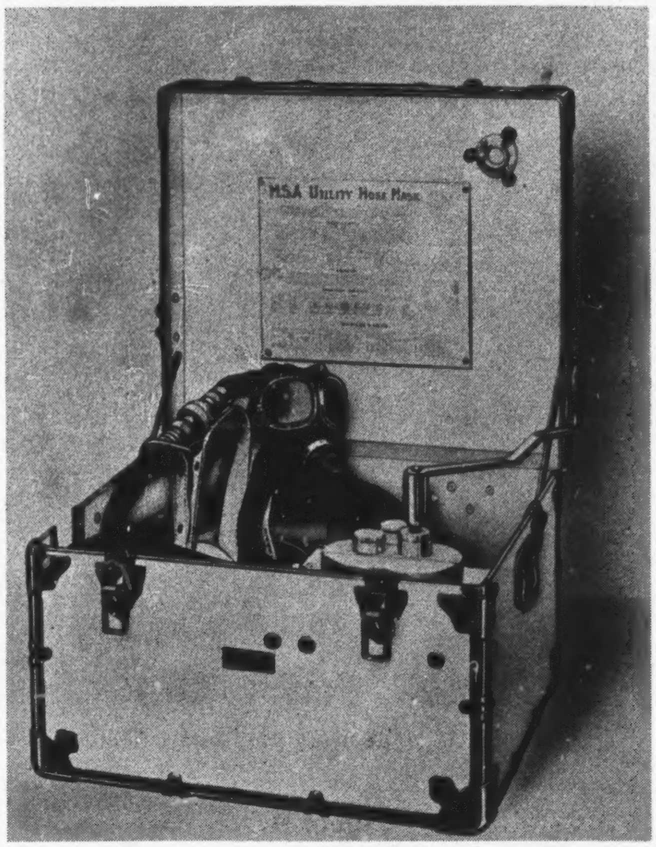
4. The top and bottom seal on the timer-type canister, and the bottom seal only on the window-indicator-type canister, should be replaced after each use.
5. Squadmen using masks should always work in pairs.
6. It is more difficult to breathe when wearing this mask because the filter restricts the rate of air flow to the facepiece.

FRESH AIR OR HOSE MASKS

The fresh-air or hose mask is suitable for respiratory protection against all atmospherical contaminants. The air-line mask belongs to this category. Air-line masks depend entirely upon a mechanical air supply which is not carried by the wearer of the mask; therefore, the failure of such an air supply would prevent escape from deadly atmospheres.

The facepiece of the air-line mask is attached to an air system by a hose. Clean air is fed to the facepiece in sufficient quantity to provide the wearer with an adequate air supply. There is little or no resistance to inhalation, and surplus air usually provides a cooling and refreshing effect. The only disadvantage is the necessity of trailing the hose which is connected to the facepiece from the air source.

Figure 5 illustrates a typical hose-mask unit. The facepiece, harness, air hose and blower are usually packed in a trunk which serves to transport the equipment and to provide the blower operator with a convenient seat. The air hose must be highly resistant to petroleum liquids and vapors, and be able to withstand crushing weight. Heavy wire reinforcing is incorporated into the construction of the hose for this purpose. Up to 150 feet of hose can be used on this type of equipment. The air hose connection is supported on the body by means of a heavy-duty harness. The facepiece is of the full-face type and is connected to the air hose by means of flexible corrugated tubing.



Courtesy Mine Safety Appliances Co.

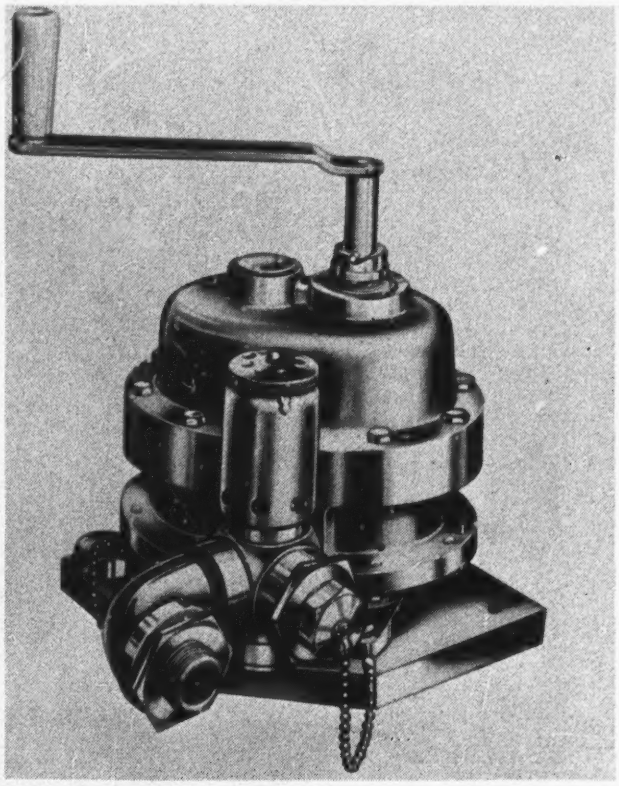
Figure 5

Typical hose mask assembly

There are two methods for supplying air to the mask. In the "constant flow" type, the breathable air is continuously fed to the facepiece. By this method there is always a slight positive pressure present in the facepiece to assure against inward leakage. Pressure is maintained by a compressor-system operated "blower". The blowers are of a low-pressure type, mostly of centrifugal design, and are available in various sizes depending upon the number of masks to be operated at any one time. The pressure on the air line should be maintained at respirable levels as recommended by the equipment manufacturer.

On U.S. Bureau of Mines approved air-line respirators, the manufacturer may specify any range of operating pressure up to a maximum of twenty-five pounds per square inch, as long as a sufficient amount of air is fed to the facepiece within the range specified. Pressure-reducing valves, as well as relief or blow-off valves, are used to control this factor. Precautions must be taken to make sure that a supply of clean air is available at the blower.

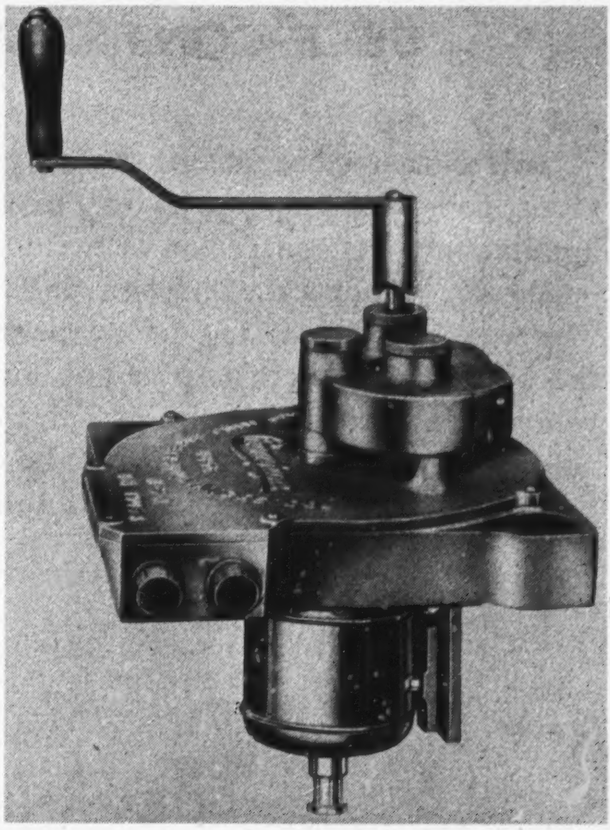
Figures 6 and 7 show two different styles of centrifugal blowers used to supply fresh air to the facepiece. Although combined motor and hand operated blowers are available, this type of unit is not approved by the U.S. Bureau of Mines.



Courtesy Mine Safety Appliances Co.

Figure 6

Centrifugal blower for fresh air mask



Courtesy Mine Safety Appliances Co.

Figure 7

Centrifugal blower for fresh air mask

In the "demand flow" type, a cylinder of compressed air or oxygen is used in place of the blower. By the inclusion of a small demand regulator, air is fed to the facepiece only upon inhalation of the wearer. The flow ceases upon exhalation. This conserves the air supply and permits one man several hours of service from a standard 220 cubic foot cylinder of air.

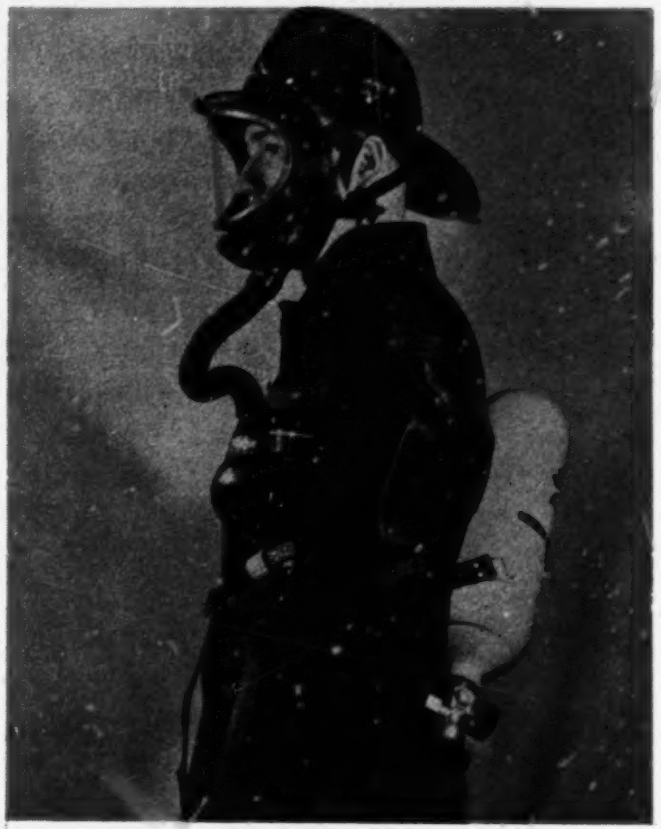
SELF-CONTAINED BREATHING APPARATUS

Self-contained breathing apparatus provides complete respiratory protection against any concentration of toxic gases, under any condition of oxygen deficiency. The wearer's breathing is independent of the surrounding atmosphere, since the wearer is breathing in a system in which no outside air is admitted, and the oxygen or air supply of the apparatus itself takes care of all respiratory requirements. Such devices enable men to work in places where they normally would not be able to stay alive. Self-contained breathing apparatus are divided into three basic types: (1) oxygen cylinder rebreathing apparatus, (2) demand-type apparatus, and (3) self-generating-type apparatus. Only two of these will be discussed here.

DEMAND-TYPE APPARATUS

All demand-type apparatus use the same principle of operation. However, some use compressed oxygen while others use compressed air.

Several different models are available. A man wearing the demand-type mask never inhales the atmosphere in which he is working. The man breathes oxygen or air supplied by a cylinder carried on the person. (See Figure 8) The flow of oxygen or air, regulated by the wearer's breathing, always assures sufficient protection. A pressure gauge indicating the amount of oxygen in the cylinder is generally provided within the wearer's view. The U.S. Bureau of Mines has issued approvals for the use of compressed air or oxygen in the different makes of masks. All are listed as one-quarter-hour and one-half-hour self-contained breathing apparatus, which indicates the length of time that the cylinders may be expected to last. The detailed instructions or information accompanying each type of mask must be carefully studied and followed before attempting to use it.



Courtesy Scott Aviation Corp.

Figure 8

Scott air pack

PUTTING ON DEMAND-TYPE APPARATUS

The following consecutive steps should be followed in putting on the apparatus before entering a toxic atmosphere:

1. Check the pressure gauge on the cylinder valve to insure that the cylinder is full (1800 p.s.i. on small units, 1980 on large units).

2. Put on the apparatus using either of the following methods; in either case caution must be used at all times to protect the regulator assembly from damage:
   a. Connect chest-strap buckle, leaving side strap unhooked; swing the apparatus over the head; and snap the side strap to the "D" ring. Fasten the waist belt snugly; pull the side straps until the apparatus is supported comfortably; and then tighten the chest strap as much as desired.
   b. Leaving the chest strap unbuckled, snap the side strap in place and put the apparatus on like a vest. First the left arm is inserted in the harness, then the right arm. Fasten the chest-strap buckle and the waist belt as securely as desired, then adjust the side straps snugly.

3. Open the cylinder valve handwheel fully (at least three turns) and close the by-pass (red) handwheel on the demand regulator.

4. Open fully and lock open with the locking lever the main line (yellow) handwheel. Observe the pressure gauge on the demand regulator. The gauge indicates continually the pressure in the cylinder; it should read approximately 1800 p.s.i. on small units and 1980 p.s.i. on large units if fully charged. If there is less pressure in the cylinder, the service life will be reduced accordingly. Turn off the cylinder valve and watch the pressure gauge on the regulator. There should be no drop in pressure if the equipment is leak-tight. If there is noticeable deflection of the needle, the equipment should be checked and the leak corrected before entering a toxic atmosphere. Again open the cylinder valve handwheel fully and lock in place with the locking lever.

5. Put on the facepiece using the following method: Check to make sure the headband straps are fully extended. Then grip the facepiece between thumb and finger. Insert the chin into the facepiece and pull headbands back over the head. To obtain a firm and comfortable fit against the face at all points, adjust headbands as follows:
   a. See that straps lie flat against the head.
   b. Tighten lower or "neck" straps.
   c. Tighten side straps (do not adjust forehead or "front" straps).
   d. Place both hands on headband pad and position it on the crown of the head.
   e. Repeat operations b and c.
   f. Tighten forehead or "front" strap as needed.

   Check the tightness of the facepiece by sealing the breathing tube with the palm of hand and inhaling gently. The facepiece should collapse on the face if the seal is satisfactory. Connect mask hose to regulator before entering contaminated area. If the facepiece is left disconnected until ready to enter the toxic area, the breathing supply will be conserved to some extent. However, if the ambient temperature is low, the facepiece will tend to fog, but will not if connected to the demand regulator.

6. Breathe normally, as the apparatus automatically satisfies any breathing requirement.

PRECAUTIONS AND PRACTICES

The apparatus furnishes complete respiratory protection for a period of time governed by the amount of exertion, but approximately 15 minutes (small units) and 30 minutes (large units), at hard work. Therefore, it is necessary periodically to check the pressure gauge on the demand regulator, as it continually indicates the pressure in the cylinder. When the needle approaches the solid-colored section of the pressure gauge, always return to fresh air because the remaining 300 p.s.i. will last only two or three minutes in the small units, and only four minutes in the large units. During normal use the by-pass (red) valve is closed; it is used only if the automatic demand regulator becomes inoperative. It provides a continuous flow and should be opened first, the main line (yellow) handwheel closed, and the by-pass valve adjusted to provide the flow desired.

REMOVING THE MASK

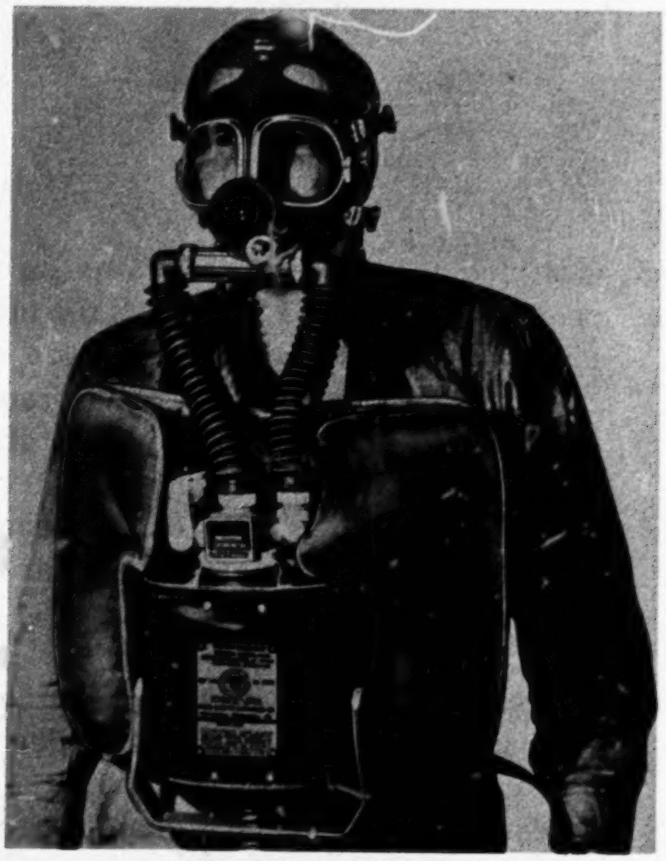
1. Disconnect the mask hose from the regulator.
2. Remove the facepiece by grasping the snout, pulling down and out, then up over the head.
3. The headstraps should then be fully extended and the facepiece should be adequately cared for.
4. Unlock the lever on the cylinder valve and close the valve using normal pressure. This valve closes leak-tight with little effort.
5. Remove the apparatus from the body and place properly in carrying case.
6. Place facepiece in the proper place in the carrying case.

CARE OF BREATHING APPARATUS AT STATIONS

1. Sterilize facepiece by cleaning thoroughly with a germicidal solution such as aqueous Zephiran 1:750 solution or Staphene solution.
2. Replace cylinder:
   a. Disconnect the coupling nut of the high-pressure hose from the cylinder valve, using the open-end wrench provided with the apparatus.
   b. Release the cylinder clamp drawbolt and remove the cylinder.
   c. Replace cylinder with a fully charged one and connect the apparatus high-pressure hose, making certain that the regulator is positioned properly.
   d. Before putting in case, make sure the pressure is released from the regulator and hose by opening and closing the by-pass valve, making sure the main line (yellow) handwheel is locked open.
3. Place the apparatus in the case with the back plate flat at the bottom, folding the harness over the cylinder. Arrange the high-pressure hose so that it is not distorted, and put the facepiece on the side.
4. NEVER USE ANY LUBRICANT ON ANY PART OF THE APPARATUS, AND ALWAYS KEEP ALL PARTS ENTIRELY FREE FROM OIL AND GREASE.

SELF-GENERATING OXYGEN MASK
FORTY-FIVE MINUTE

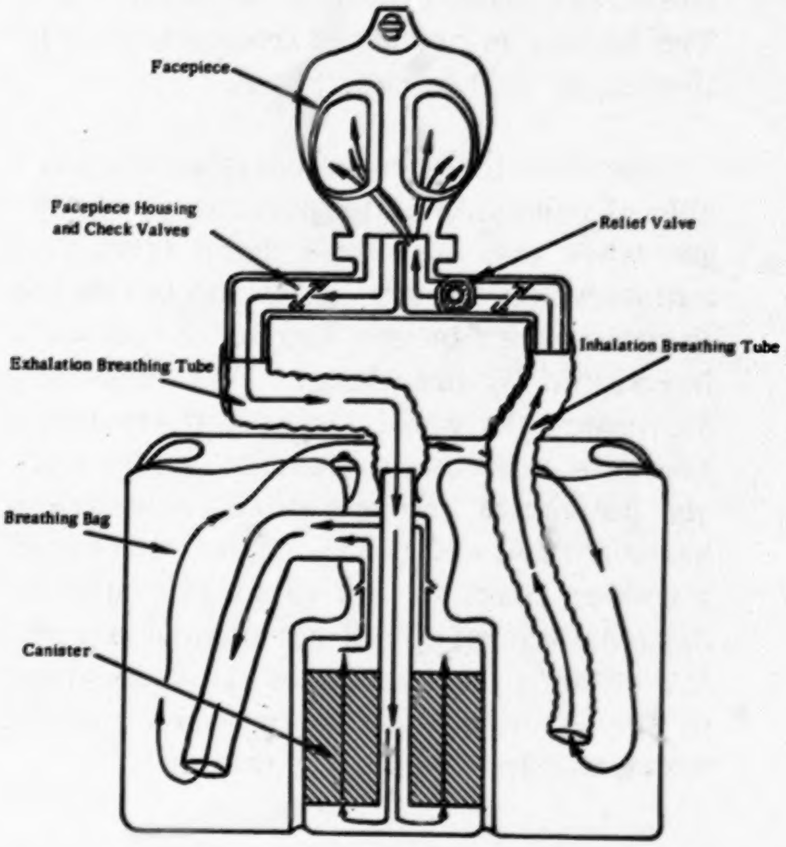
Unlike the conventional type of breathing apparatus which employes cylinders of oxygen or compressed air under high pressure, this apparatus evolves or generates its own oxygen. It operates independently of the outside air and provides complete respiratory protection in oxygen-deficient or highly gaseous atmospheres. The wearer breathes into the facepiece through the exhalation tube into the canister. The exhaled breath is purified of carbon dioxide and replenished with oxygen as it passes through the canister, and is then rebreathed. This mask provides protection for forty-five minutes. (See Figures 9 and 10).



Courtesy Mine Safety Appliances Co.

Figure 9

Chemox 45-minute mask


Facepiece
Facepiece Housing and Check Valves
Relief Valve
Exhalation Breathing Tube
Inhalation Breathing Tube
Breathing Bag
Canister

Courtesy Mine Safety Appliances Co.

Figure 10

Cross-section diagram of Chemox 45-minute mask

The apparatus consists of a facepiece, breathing tubes, breathing bag, breastplace, canister holder, harness straps and a manual timer, all focalized around a central casting just above the canister. The facepiece valve assembly, located immediately below the facepiece, is equipped with a pressure-relief valve. This is a one-way valve that acts as a manual pressure-release valve when the breathing bag becomes over-inflated. This assembly also contains the exhalation and inhalation valves which control the directional flow into and out of the breathing bag. The breathing bag serves as a reservoir for the evolved oxygen, and at the same time acts as a cooler for the air coming from the canister.

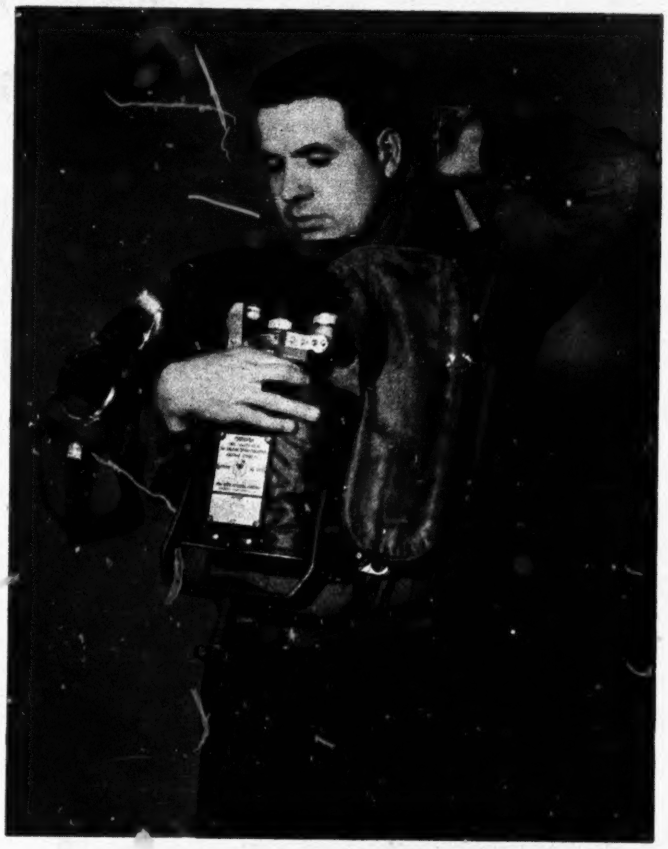
The chemicals in the canister purify the exhaled breath by absorbing the carbon dioxide and generating fresh oxygen for breathing. The resultant chemical action liberates considerable heat in the canister. The wearer is protected from this heat by insulation on the breastplate.

The chemicals in the canister are capable of releasing a high percentage of oxygen when they become damp from the moisture in the breath. The rate of release is governed by the amount of moisture introduced by breathing. For breathing purposes, the water vapor in the exhaled breath is sufficient to liberate enough oxygen for comfortable breathing. Any excess moisture that enters the canister will cause a sudden reaction and rapid liberation of oxygen. Therefore, do not introduce water into either a used or unused canister except to dispose of it, and then only in a manner which will be described later.

PUTTING ON SELF-GENERATING OXYGEN MASK

The following are the consecutive steps in putting on the apparatus before entering a toxic atmosphere. The apparatus must always be put on in fresh air.

1. Unfasten and straighten all harness straps.
2. With one hand, grasp the apparatus by the central casting and drop the facepiece over the hand holding the apparatus. With the other hand, grasp the D-ring assembly where the two large web straps join; place the breastplate of the canister holder on the chest and slip the head through the V-shaped opening formed by the two web straps. See Figure 11.



Courtesy Mine Safety Appliances Co.

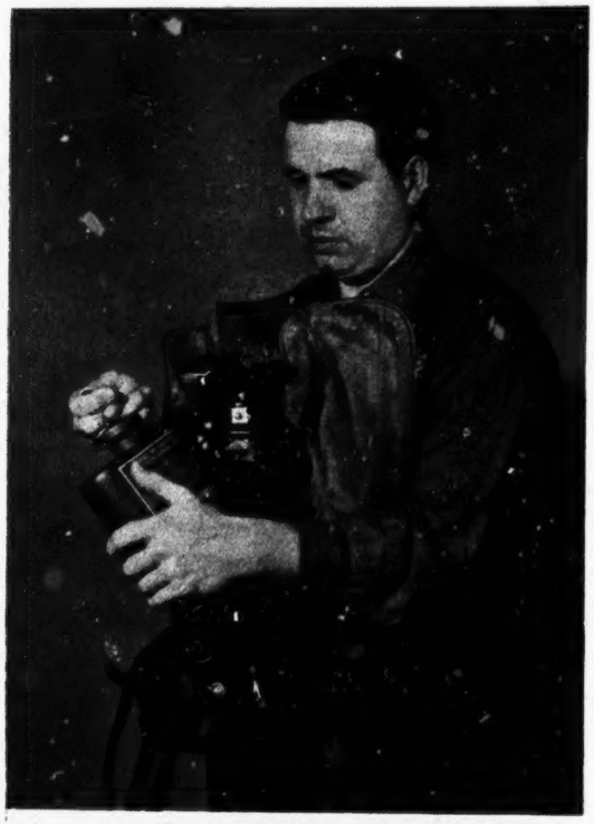
Figure 11

Putting on apparatus

3. Continue to hold the apparatus on the chest with one hand, and with the other reach around the body at one side and grasp the free end of the web strap on that side. Bring the end of the strap under the arm and snap into the D-ring located on the top side of the breastplate. Repeat this procedure for the other strap.
4. Adjust the position of the apparatus on the body by means of metal slides located on the web harness straps. This adjustment can also be accomplished by twisting the straps to obtain the proper length. The position of the apparatus on the body should be such that when the facepiece is put on the breathing tubes will permit free head movement.

5. Attach the waist strap to the small D-ring located on the lower corner of the breastplate and pull to a snug fit. Then tuck in the waist strap loop.

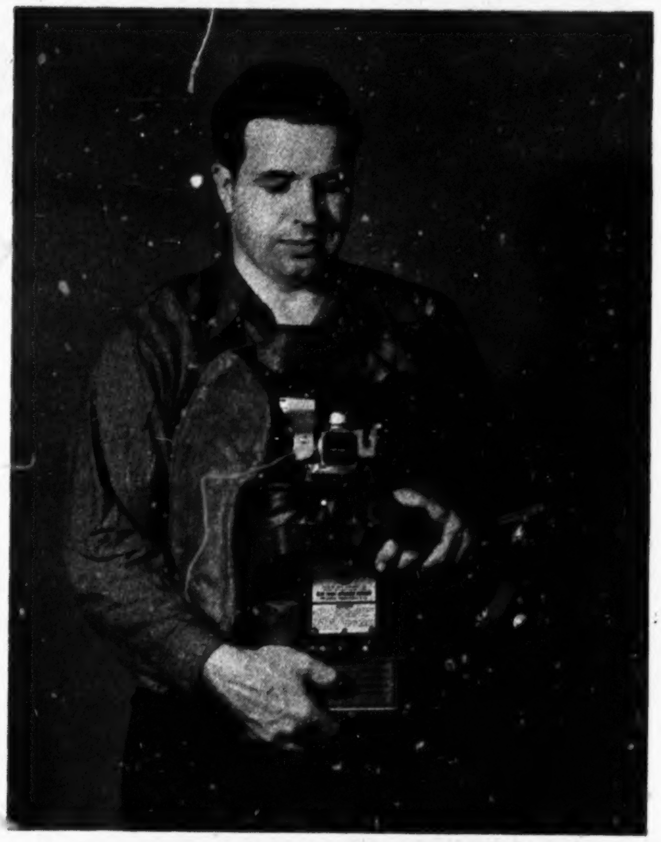
6. Remove the metal tear-off cap of the canister by pulling the metal tab straight out, then straight back across the top of the cap, exposing the copper foil seal which is the air-tight seal for the canister. Make sure that the metal and cardboard discs are removed exposing the copper foil seal. (See Figure 12). Screw the handwheel down far enough for the bail to be swung outward, swing the bail outward and swing the canister fully into the canister holder with the smooth side toward the front. The canister should be inserted sufficiently so that the cooper foil seal is punctured and the rubber gasket fits snugly against the V-shaped recess in the plunger casting. Screw the handwheel clockwise until it is tight against the canister. The canister must be inserted with the smooth side to the front. See Figure 13.



Courtesy Mine Safety Appliances Co.

Figure 12

Removing metal tear-off cap of canister

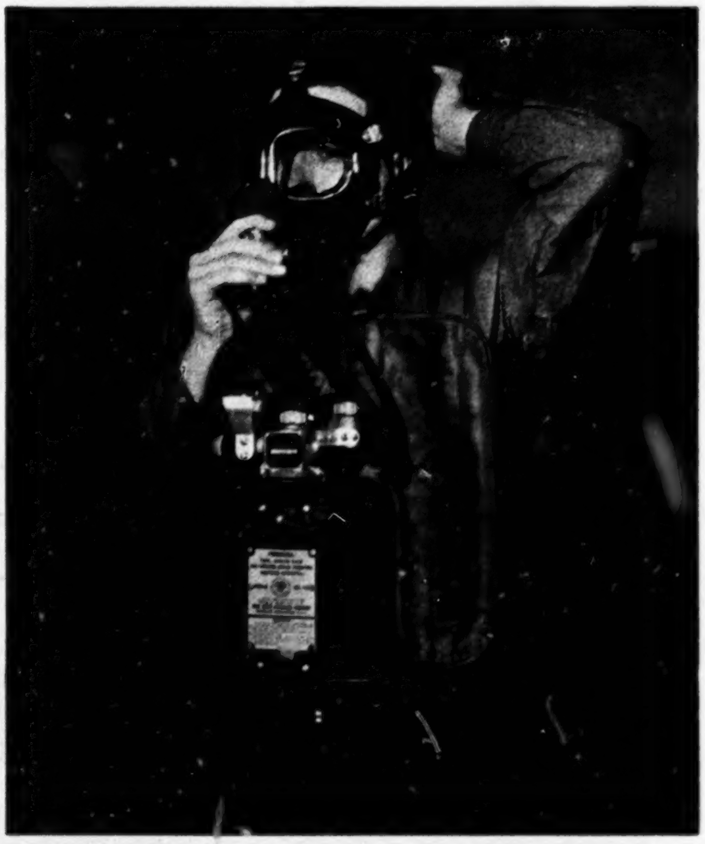


Courtesy Mine Safety Appliances Co.

Figure 13

Inserting canister in apparatus

7. Pull out the facepiece straps so that the ends are at the buckles; grip facepiece between thumb and fingers. Insert chin well into the lower part of the facepiece and pull the headbands back over the head. See Figure 14.



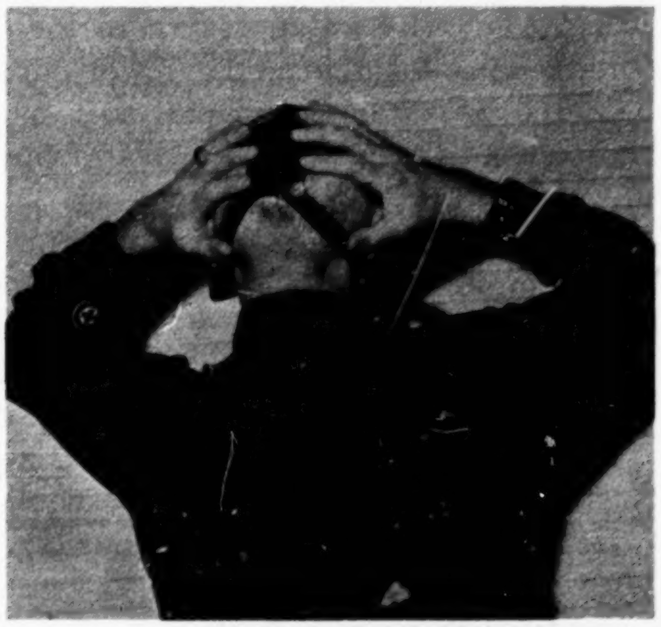
Courtesy Mine Safety Appliances Co.

Figure 14

Putting on facepiece

To obtain a firm and comfortable fit against the facepiece at all points, adjust headbands as follows:

a. See that straps lie flat against head.
b. Tighten lower or "neck" straps.
c. Tighten the "side" straps. (Do not touch forehead or front straps).
d. Place both hands on headband pad and push it toward the neck. See Figure 15.
e. Repeat operations b and c.
f. Tighten forehead or "front" strap a few notches if necessary.
g. Check the tightness of the facepiece fit by squeezing the breathing tubes and inhaling. The facepiece should collapse on the face if the seal is satisfactory.

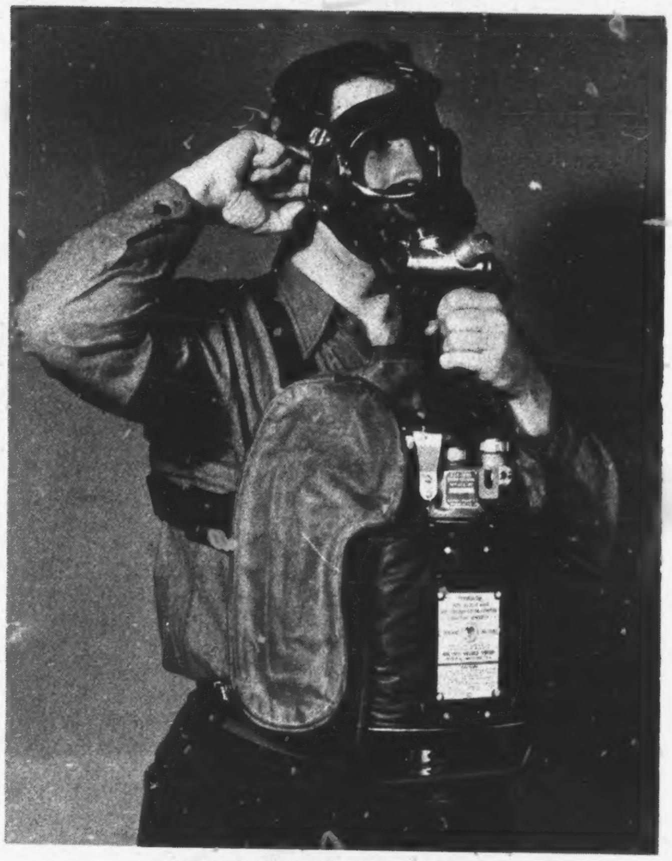


Courtesy Loudonville, O., F.D.

Figure 15

Adjusting headband pad

8. Squeeze both breathing tubes with one hand, and break the seal of the facepiece against the cheek with fingers of the other hand. Inhale; then releasing facepiece with breathing tubes, exhale into the apparatus. See Figure 16. This must be done in fresh air. Repeat this procedure until the breathing bag is inflated. In order to be certain the canister is generating oxygen, depress the pressure-relief valve and force the air from the breathing bag; then reinflate the breathing bag by the method described above. In cold weather, starting the proper chemical reaction in the apparatus will require more inhalations from the outside air, with exhalations into the canister. The best procedure is to continue alternately inflating the breathing bag fully, then deflating it with the elbows, until a total of about 15 exhalations have been put through the canister.



Courtesy Mine Safety Appliances Co.

Figure 16

Starting apparatus

9. To check the complete apparatus for tightness:

    a. Grasp the lower end of the inhalation (left) breathing tube and squeeze it tightly. Inhale. If the facepiece collapses the facepiece seal is tight enough and the exhalation valve is functioning properly. This will also test the upper part of the inhalation breathing tube for leaks.

    b. Continue to squeeze the lower end of the inhalation (left) breathing tube. Depress the pressure-relief valve button. It should then be possible to exhale through the valve. While holding the button down, inhale; if the facepiece collapses as above, the relief valve is functioning properly.

    c. Release the inhalation (left) tube and squeeze the lower end of the exhalation (right) breathing tube. Inhale and then exhale forcibly. The exhaled air should be forced out between the face and the facepiece only; this will indicate that the inhalation valve is functioning properly and the upper end of the exhalation tube is free of leaks.

    d. With the bag well inflated, grasp the upper ends of both breathing tubes and depress both sides of the breathing bag with the elbows. If the breathing bag does not deflate, the complete apparatus is airtight.

IF A LEAK OR DEFECT IS INDICATED IN ANY PART OF THE APPARATUS, IT SHOULD BE CHECKED AND THE CONDITION CORRECTED BEFORE USE.

10. Breathe normally; the apparatus will furnish enough oxygen to meet most breathing requirements.

11. Since the apparatus has a forty-five minute service life at hard work in an irrespirable atmosphere, it will be necessary to determine the length of time required to return to fresh air from the working place and set the timer accordingly. The timer dial is calibrated in minutes. Turn the pointer clockwise to the number of minutes left after deducting the time for exit; the timer will then be properly set. For example, if it will take ten minutes to return to fresh air, deduct ten minutes from forty-five and set the timer at thirty-five. The bell on the timer will ring when the pointer returns to zero, at which time the wearer has ten minutes to return to fresh air.

PRECAUTIONS AND PRACTICES

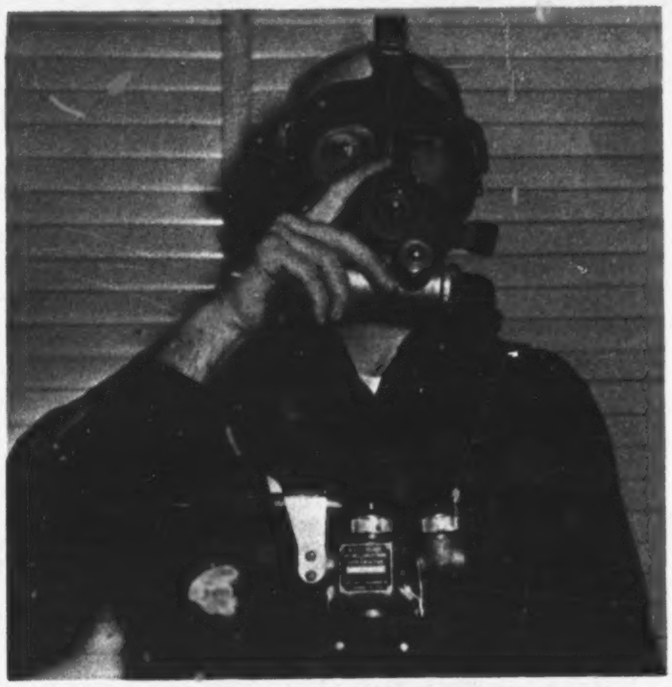
1. There is no need to purge nitrogen manually from this apparatus, since more oxygen is produced than will be used. To relieve excess pressure, depress the pressure-relief valve on the valve housing at the bottom of the facepiece.

2. In addition to the timer there are two other indications that the canister is becoming expended: fogging of the lenses on inhalation and increased resistance on exhalation. These two indications will not normally appear until after forty-five minutes of use, but under conditions of extreme hard work may become noticeable. The lenses will clear on inhalation until the canister is almost expended; then the lenses will begin to fog. Do not confuse excess breathing-bag pressure with canister resistance. If the pressure-relief valve relieves excess breathing-bag pressure, and exhalation resistance is still present, the canister is about expended. If either of these two indications appear, return to fresh air.

AFTER USE

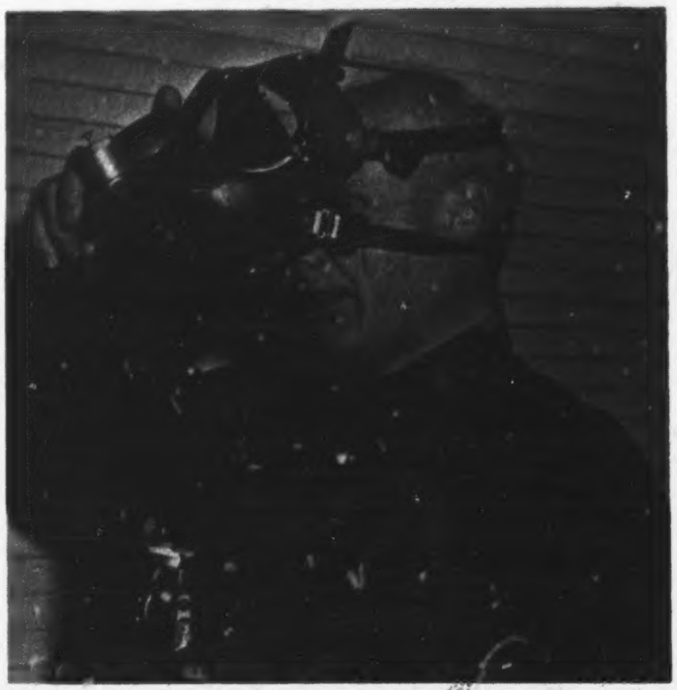
As soon as it is safe to remove the facepiece, this should be done by grasping it at the "snout" with the hand and pulling forward and upward off the head and face. (See Figures 17a and 17b.)

To remove the canister, turn the handwheel down, swing bail outward and remove the canister with the hand suitably protected by a glove or other covering, since the canister may be hot.



Courtesy Loudonville, O., F.D.

Figure 17A



Courtesy Loudonville, O., F.D.

Figure 17B

Removing mask

Upon return to quarters, after the mask has been in service, the used canister may be disposed of as follows:

1. Allow the canister to cool. Ordinarily this will take place while returning to quarters.

2. Place the canister on the floor, smooth side up, and gash it with an axe that has been wiped clean of oils, greases or other materials. Two cuts can be made with the axe, one on each side of center. Keep your face away from the open canister; it contains caustic chemicals.

3. Place the canister in a bucket 2/3 full of clean water. When the chemical reaction or agitation stops, rinse the canister off with clean water. Pour the bucketful of water carefully down a sewer or drain. This water will now be a caustic solution and will irritate the skin if allowed to come into contact with it.

After use, the facepiece of the apparatus should be sterilized using a germicidal solution such as aqueous Zephiran 1:750 solution or Staphene solution. Allow the facepiece to hang down while cleaning, so no liquid enters the valve assembly or tubes. Immediately after sterilization, wipe the facepiece dry and replace on the apparatus for service.

GENERAL CARE

A canister should not be carried in the canister holder while it is in the carrying case. Each carrying case should contain two canisters and the mask at all times. When a canister has been removed from the canister holder it should not be used again. Care should also be taken that canisters do not come in contact with oils and greases: The chemicals in a canister are capable of generating and releasing highly concentrated oxygen that could start combustion.

Do not tie a rope to the D-ring on the harness strap of the mask.

The inhalation and exhalation check valves can be removed from the facepiece and breathing tube by disconnecting the toggle clamps, removing the breathing tubes, and sliding the valves out. The valves should be checked periodically for corrosion and replaced if necessary, These valves are marked "in" for inhalation and "ex" for exhalation, and should be inserted in the respective openings in reassembly.

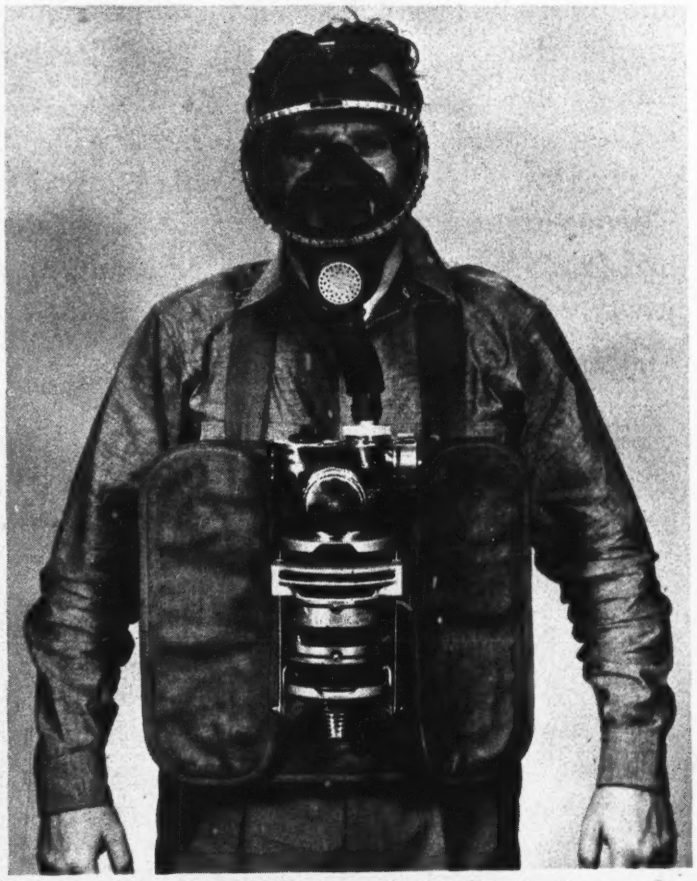
This type of breathing apparatus should not be used under water, such as in pools, lakes or ponds.

As a part of the general care, there should be a periodic check of the plunger and plunger casting (the part which pierces the canister) for cleanliness and free movement of the plunger. The tightness of the apparatus should also be checked periodically, using the procedure outlined in 9 under "Putting On Self-Generating Oxygen Mask".

When any part shows evidence of failure, it should be replaced immediately with a new part. Damaged apparatus should be returned to the factory for repair.

SELF-GENERATING OXYGEN MASK
THIRTY MINUTE

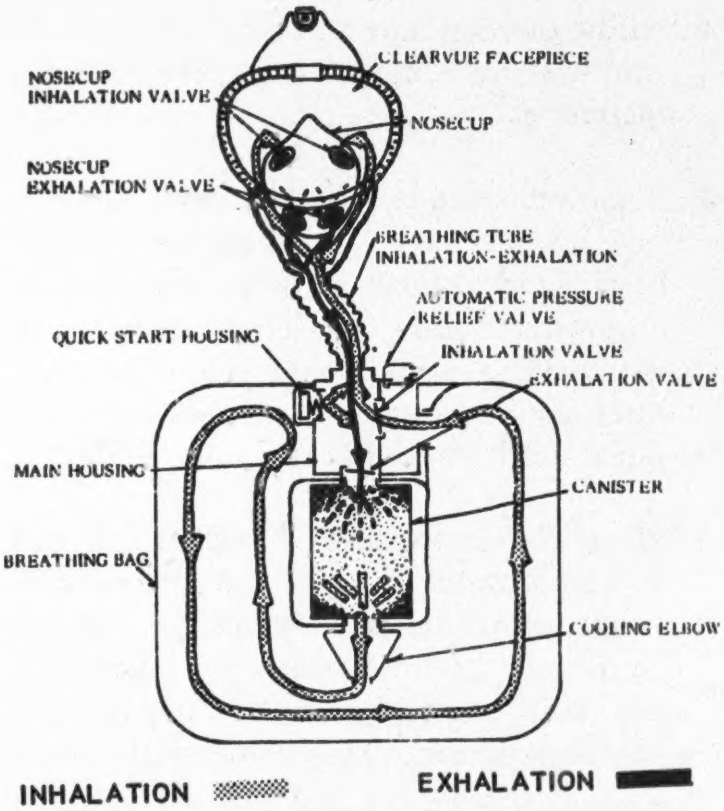
This mask, like the one previously described, is a canister type which evolves or generates its own oxygen. (See Figure 18.) Thus it is independent of the outside air. The wearer's breath passes into the facepiece and through the exhalation tube, into the canister. The exhaled breath is purified of carbon dioxide and replenished with oxygen as it passes through the canister and is then rebreathed. (See Figure 19.) This mask will provide respiratory protection for thirty minutes.



Courtesy Mine Safety Appliances Co.

Figure 18

Chemox 30-minute mask


CLEARVUE FACEPIECE
NOSECUP INHALATION VALVE
NOSECUP
NOSECUP EXHALATION VALVE
BREATHING TUBE INHALATION-EXHALATION
AUTOMATIC PRESSURE RELIEF VALVE
QUICK START HOUSING
INHALATION VALVE
EXHALATION VALVE
MAIN HOUSING
CANISTER
BREATHING BAG
COOLING ELBOW
INHALATION ▨
EXHALATION ■

Courtesy Mine Safety Appliances Co.

Figure 19

Cross-section diagram of Chemox 30-minute mask

The apparatus consists of a facepiece, breathing tube, (both the inhaled and exhaled air pass through this one tube), breathing bag, breastplate canister holder, manual timer, and harness straps, all focalized around a central housing just above the canister. An automatic pressure-relief valve is located in the central housing on the inhalation side of the breathing bag. This is a one-way valve; it operates automatically when the breathing bag becomes over-inflated. Also located in the central housing are the quick-starting housing -- a unit that activates the apparatus instantly in low temperatures -- and the exhalation and inhalation valves which control the directional flow into and out of the breathing bag. The breathing bag serves as a reservoir for the evolved oxygen.

The timer, located in the central housing, is a safety device to inform the wearer how long the canister has been in service. Since the mask is good for thirty minutes, the timer dial is calibrated in minutes from one to thirty. Turning the timer knob clockwise to thirty winds it. If left untouched in this position it will automatically unwind with a continuous movement to zero. This will indicate the end of thirty minutes and the bell will ring continuously for 17 seconds. The timer is entirely independent of the apparatus and will continue to unwind even though the apparatus is not in use.

The canister on this mask is different in appearance than the canister used on the regular self-generating type in that it is cylindrical in shape and has an opening on each end. The chemical in this canister is the same as in the other canister, so the same precautions should be taken as to introduction of water or moisture into the canister.

The chemical in the canister purifies the exhaled breath by absorbing the carbon dioxide and generating fresh oxygen for breathing. This chemical action generates considerable heat in the canister. The wearer is protected from this heat by insulation on the breastplate and by a cooling elbow incorporated in the canister holder to cool the evolved oxygen before it enters the breathing bag.

PUTTING ON THE MASK

The following are the consecutive steps in putting on the apparatus before entering a toxic atmosphere:

1. Unfasten and straighten all harness straps.
2. Grasp the apparatus at the top of the canister holder with one hand. With the other hand grasp the harness D-ring assembly where the two large nylon straps join. Place the breastplate canister holder over the chest and slip the head through the V-shaped opening formed by the straps.
3. Continue to hold the apparatus on the chest with one hand and with the other reach around the body and grasp the free end of one strap. Bring the end of the strap under the arm and snap into the D-ring located on the top side of the breastplate. Repeat this procedure for the other strap.
4. Adjust the position of the apparatus on the body by means of the metal slides located on the harness straps. This adjustment can also be accomplished by twisting the straps to obtain the proper length. The position of the apparatus on the body should be such that when the facepiece is put on, the breathing tube will permit free head movement.
5. Attach the waist strap to the small D-ring located on the lower corner of the breastplate and pull it up to a snug fit, tucking in the loose ends.
6. Open the canister holder by pressing on both the pawls at the top and pulling the lever arms outward.
7. Remove the two canister caps by inserting each end in the opener at the bottom of the canister holder and pulling upward (as in removing a bottle cap).
8. Make sure the canister-holder lever arms are fully at their bottom position and insert the canister in the canister holder with the top of the canister at the top of the canister holder. Note: The canister label has an arrow pointing to the top and reads: This end up.
9. Close the canister lever arms securely.
10. Connect the coupling nut on the facepiece tube to the mating thread on the upper main housing.

11. After the facepiece has been donned, check the tightness of the fit by squeezing the breathing tube tightly and inhaling gently. The facepiece should collapse on the face if the seal is satisfactory.

12. The apparatus is started by one of two methods, depending upon whether a quick start cartridge is used. For either method leave the automatic pressure-relief valve (on side of upper main housing) in the normal starting position.

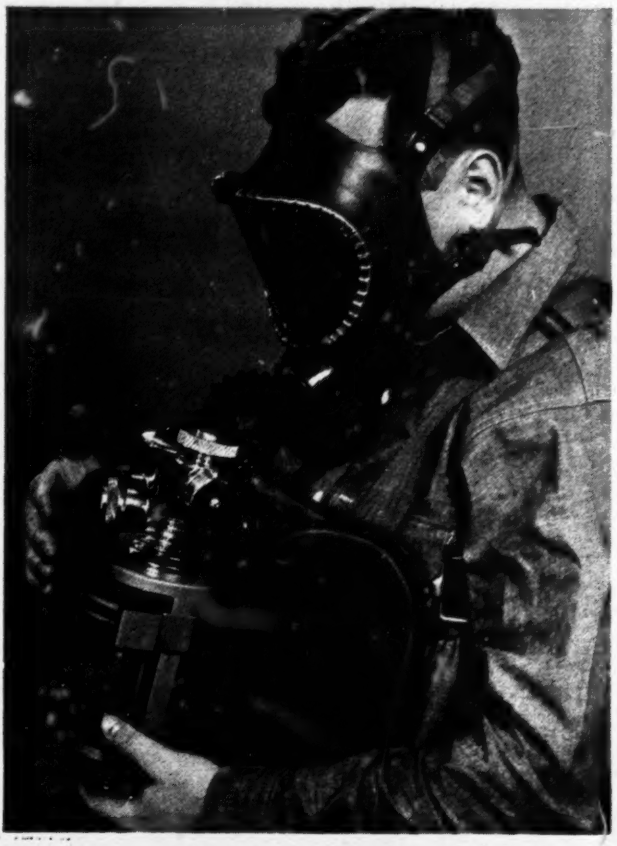
    Without a quick-start cartridge proceed as follows in fresh air.

    a. Squeeze breathing tube with one hand, break the seal of the facepiece at the cheek with a finger of the other hand, and inhale deeply.
    b. Release facepiece, then breathing tube, and exhale into the apparatus.
    c. Repeat a. and b. until the automatic pressure-relief valve dumps air.
    d. Force the air from the breathing bag through the pressure-relief valve by squeezing the bag with both hands.
    e. Repeat operations a., b., and c. until breathing bag is fully inflated.

If normal starting is to be used, the apparatus should be stored and started at temperatures above 32° F. When the apparatus is stored and started at temperatures above 32° F., the wearer may enter and wear the apparatus down to a temperature of -20° F. When starting the apparatus at temperatures near freezing, more inhalation from the outside air, with the exhalation into the canidter, may be required to produce the proper chemical reaction. The best procedure is to keep fully inflating and deflating the bag until a total of about 15 exhalations have been put through the canister.

The quick-start cartridge may be used with the following procedure:

a. Remove cartridge from metal container.
b. Remove cartridge-holder cover from front of main housing by unscrewing it.
c. Insert cartridge: the solid side with the brass percussion cap goes to the front (away from body).
d. Replace cover, screwing it in tight.
e. With facepiece well fitted, strike the cartridge cover a sharp rap with the heel of the hand. (See Figure 20.) Oxygen will evolve automatically to inflate the bag fully, and some excess will vent automatically. Nothing further is necessary to start the apparatus.



Courtesy Mine Safety Appliances Co.

Figure 20

Starting the half-hour Chemox

13. Regardless of the starting method, a tightness test should be performed on the unit as follows:

    a. Set relief valve in the test position. This closes the valve so that automatic venting does not take place.
    b. With the bag fully inflated, grasp the breathing tube tightly and depress both sides of the breathing bag with the elbows. If the bag does not deflate, the complete apparatus is tight.

IF A LEAK IS DETECTED, IT SHOULD BE CORRECTED BEFORE USE IN A TOXIC ATMOSPHERE.

    c. Reset relief valve to normal position.

14. Breathe normally; the apparatus will furnish enough oxygen to meet any breathing requirements.

15. Set the knob of the timer at 30. When the pointer end of the knob returns to zero, the bell will ring continually for 17 seconds. The wearer should then return to fresh air.

16. The facepiece of this mask contains a speaking diaphragm permitting communications.

PRECAUTIONS AND PRACTICES

The proper care of this apparatus and safe disposal of the canister are the same as with the regular self-generating oxygen mask previously described.

AUDIBLE COMMUNICATION WITH RESPIRATORY PROTECTIVE EQUIPMENT

Most facepieces on respiratory protective equipment of late manufacture are furnished with a speaking diaphram. Without such a speaking diaphragm, audible communication between wearers of respiratory equipment is inadequate at best, and at times may be impossible. Facepieces with an exhalation valve provide some measure of voice transmission through this valve, and even those without exhalation valves permit an extremely limited transmission through the rubber facepiece. However, a greater degree of audible transmission is provided by modern scientifically designed speaking diaphragms.

TRAINING SUGGESTIONS

1. Wear mask for a short period in fresh air, and do some work or exercise. This will allow you to become accustomed to the mask and learn the breathing technique.

2. Wear mask in gas and smoke to become familiar with conditions where gas and smoke exist.

3. While wearing mask in gas and smoke, do some work. It is under these conditions that the mask will be used.

4. Practice donning mask with helper and without helper.

SUMMARY

It is recommended that squadmen using gas masks always work in pairs and be in constant audible communication with each other.

The squadman who needs a mask should not run to the truck for it; the mask should be brought to him if possible. A mask should not be donned when a person is short of breath.

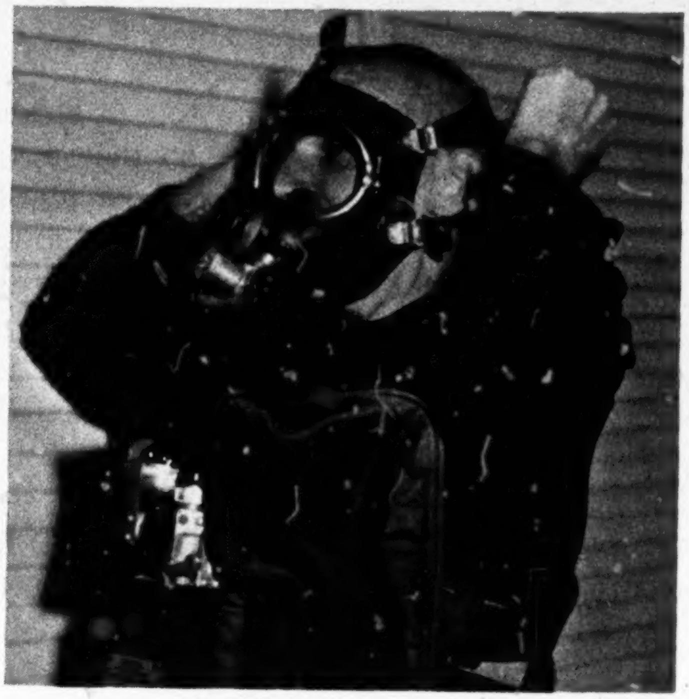
The harness straps, on all masks, should be previously extended to fit the largest man who may wear the apparatus. Masks having the slower type of adjusting harness strap can be quickly adapted to fit a smaller man by twisting these straps.

After working in areas of highly toxic chemicals, gases or radioactive material, it is advisable not to remove the mask upon return to fresh air until the contaminant has been removed from the clothing.

In donning the facepiece of any mask the headband straps should be tightened by pulling these straps straight back as shown in Figure 21, and not outward from the side of the head as shown in Figure 22.

Extra tanks and/or canisters should be carried on emergency apparatus. A guide line or rope should not be tied to the harness or D-ring of the mask. When a guide line is used, it should be fastened around the squadman's body before the mask is donned.

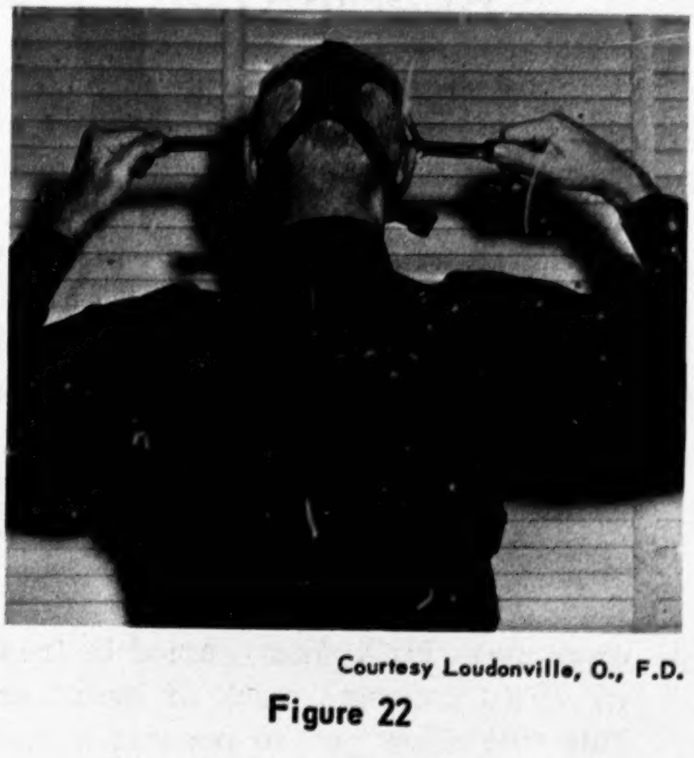
Where gas masks are not in regular use, they should be removed from their carrying cases periodically and donned by personnel. This will prevent the materials in the mask assembly from becoming stiff or hardened from lack of use, and keep them pliable.



Courtesy Loudonville, O., F.D.

Figure 21

Tighten straps like this.



Courtesy Loudonville, O., F.D.

Figure 22

Do not tighten straps like this.

CHAPTER XVIII

ELECTRICAL EMERGENCIES

INTRODUCTION

A squadman is not presumed to be an electrician nor an electrical lineman, but his duties may require him to face situations involving electrical equipment or wiring. Therefore he should be able to recognize electrical hazards and should know the proper action to take.

Saving property alone never justifies the risk of a man's life. Where life is involved, the urgency is greater; necessity prompts the squadman to act in the face of great danger. However, he should THINK before he ACTS. Moreover, unless he KNOWS what he is doing, he should seek help from a qualified person. Electric power has become so common that facilities for supplying electricity are present in almost every part of every community. Emergency and rescue squad personnel can prepare themselves to deal with electrical hazards by learning methods for handling electrical equipment and wiring.

The information in this chapter is merely suggestive. It is the responsibility of the department head, or the emergency squad officer, to reach an agreement with the appropriate officials of the local power company as to procedures to be followed in an emergency involving the company's property and equipment, or any other property where electrical equipment or wiring is concerned. All squadmen, and all power-company employees who are subject to call when an emergency occurs, should be thoroughly familiar with whatever procedure has been mutually approved. In many cities a power-company unit responds to each emergency where electrical hazards may be encountered. Regardless of this policy, someone must call the power company immediately when any emergency involves electrical hazards within the company's area. The squadman requesting assistance from the power company must clearly inform the receiver of the call as to the electrical equipment involved (transformer, overhead wires, underground cables, etc.) and its location. This will facilitate service and make for maximum cooperation.

RECOGNIZING THE DANGER

All wires are potentially dangerous. Fallen, energized wires are an extreme hazard to anyone who is not familiar with electrical behavior in wires under the stress of a ground or short circuit. The actual threat to life is determined by the amount of current or amperage that flows through a person's body.

The pressure applied to cause a current or amperage to flow is called voltage. Under some circumstances, a very low voltage can send enough current through a person's body to cause serious injury or death. This is particularly true if the person is standing on the ground or on a well-grounded structure. The flow of current is from a wire to the ground. Anything or anyone within this path may become the conductor for the current from the point of contact on the wire or electrically charged object to the point of contact on the ground.

CHARGED GROUND NEAR A FALLEN WIRE

It is dangerous even to approach a fallen wire. Distribution or transmission wires, in particular, may energize the ground for a considerable area around the point where they make contact. It is impossible to give specific rules or distances, since the danger area will vary with the voltages involved and with ground conditions. The hazard is much greater during damp or rainy weather.

CIRCUIT BREAKERS

Wires lying on the ground may be de-energized one moment and energized the next. While energized they may whip around, and this is an additional hazard. Self-operating devices protect most power systems from surges and grounds. These devices open a circuit when it is overloaded or shorted and then, in a matter of seconds, automatically close the circuit. The setting on this equipment may vary from one to four seconds.

INVISIBLE DANGER

Energized wires lying on the ground or across a vehicle may show no evidence of being live, yet touching the wire or the vehicle may be fatal. If an electric wire should fall across a fence or telephone wire, they are as dangerous as the live wire itself and the same precautions must be taken.

ACTING IN AN EMERGENCY

The only completely safe thing to do with fallen wires is to stay clear of them and call the power company. In some cases, however, waiting for the power company crew may mean the difference between life and death. Therefore, it is essential for rescue squad personnel to have a reasonable working knowledge of the electrical hazards and emergency situations that may confront them in each community they service.

If wires are down, on arrival at an emergency proceed as follows:

Radio for the power company and move the crowd back from the danger zone (at least one span each way from the break or the sagging wire.) This is necessary for several reasons.

1. The spans of wire adjacent to the trouble may have been weakened.

2. Any movement of the wires in trouble, caused by the wind or rescue work, may burn other wires down.

3. Wires on the ground may burn through at some point and the ends may curl up, roll along the ground, and cause injury to someone.

4. Burns, electric shocks, or eye injuries from electric flashes may occur even though a person is not in direct contact with the wires. Therefore, do not permit anyone to stand near weak or broken wires.

EMERGENCIES INVOLVING VEHICLES

In case of a motor vehicle, the rubber tires may insulate the vehicle from the ground, so that although the vehicle itself may be charged, there will be no current flowing from the vehicle to the ground. In such case, passengers in the vehicle will be relatively safe if they remain in it. A person touching the vehicle while standing on the ground will complete the circuit from the vehicle to the ground, creating a path of current flow through his body which can often prove fatal.

An example is that of a woman whose car became energized from a fallen wire as the result of hitting a light pole. In her fright, she jumped out of her car. After moving away from the car, she realized she had left her purse in the seat of the car. She returned to the car and, upon touching the door, was instantly electrocuted.

Charged Emergency Apparatus

If either metal or wood aerial ladders come in contact with overhead electric wires, or should these wires fall across the apparatus, a person will be relatively safe providing he DOES NOT make contact with the apparatus and the ground at the same time. If the equipment is believed to be in contact with a live wire, and you must get off, DON'T STEP OFF - JUMP OFF. Your hands, feet, and body must clear the vehicle completely before you touch the ground. From the moment that you contact the ground, you must not again touch the vehicle.

HANDLING ENERGIZED WIRES

If a dry rope is thrown from a reasonable distance over wires carrying high voltage, the person throwing it will not be harmed. If the rope is wet when placed in contact with energized wires, the man can receive a shock which may prove fatal.

Polypropylene rope is completely non-conductive. It will not absorb moisture. This type of rope is ideal for use with electrical hazards.

ROPE-AND-WEIGHT TOOL

If action is necessary to remove a wire from a victim, a rope-and-weight tool can provide a means to handle wires safely in any weather. However, the squadmen must be thoroughly trained in its use. Men who can throw the weights efficiently will be able to pick up a live wire with relative safety, regardless of the position in which it falls.

This rope tool consists of two weights, each weighing approximately one-half pound, attached one to each end of a 100-foot, one-quarter-inch rope. (See Figure 1.) The rope must be free of any metallic substance, to be safe in use. Any emergency unit can make this devices for little cost. It is recommended that one be in service on each unit in operation.

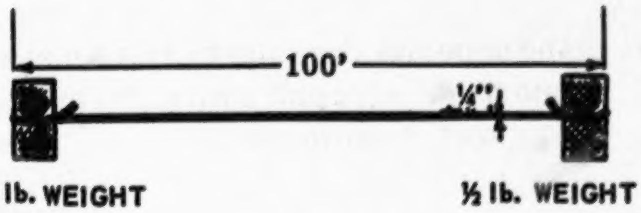


Figure 1

Tool made with rope and two weights, for handling live wires

USING THE ROPE

Emergency squadmen should be trained in the use of the weighted rope. Only practice can make them proficient in handling live wires safely in this manner.

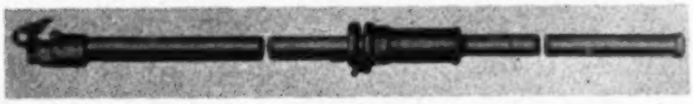


Figure 2

Hot stick

With this tool a squadman can gain control of a fallen wire without getting near the wire. After the rope is in contact with the wire, approved and adequate insulating equipment will allow him to move the wire by pulling on the rope. A pair of approved lineman's rubber gloves and glove protectors, and a lineman's "hot stick", tested for use on high voltage, are required. (See Figure 2.) With this equipment the wire may be moved as follows:

1. Clear all persons out of the danger area, as described earlier.

2. Put on lineman's rubber gloves and glove protectors.

3. Stand opposite the point to which you want to move the wire and approximately thirty feet from the wire.

4. Toss one end of the weighted rope under the wire to a point about equal to your distance from the wire, on the other side. (See Figure 3.)

5. Toss the other end over the wire so that it lands near the first weight thrown.

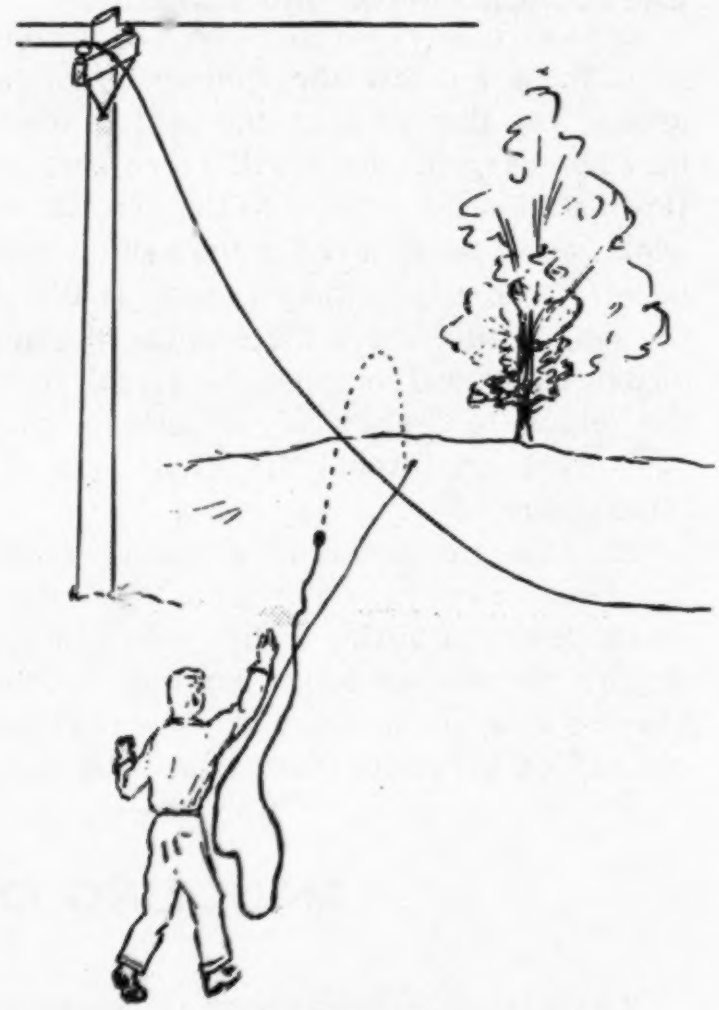


Figure 3

Man throwing rope with weights

6. Pick up the two weighted ends with the hot stick, and drag the wire out of the way. (Be sure the wire is guarded.)

7. Keep in mind at all times that the ground may be energized for some distance around the fallen conductor.

It must be remembered that any fallen wire is dangerous and that it can mean instant death to the poorly trained emergency rescue squadman. However, when a human life is involved, squad personnel will have to take immediate rescue action. In such situations the action taken will be founded on past experiences and training. Here every second counts, yet caution must be exercised so that the seriousness of the original emergency is not increased because of the over-zealous action taken by a squadman or other person nearby.

HOT STICKS

Hot sticks are specially designed tools used principally by electric company linemen to manipulate energized conductors into a desired position. They are specially treated by the manufacturer to prevent moisture from penetrating the wood. They should be kept in a compartment or other container on the rescue truck to prevent damage while in storage. They should be inspected at regular intervals by someone who knows their construction even if they have not been used since the last inspection.

REMOVING VICTIM FROM WIRE

When a person is found lying on an energized wire, and the wire is not entangled around the victim, a quick method to rescue him is to employ a hot stick to push or pull him from the wire. While the victim is being removed from an energized line he may receive additional burns, but this is not as serious as having him remain in contact with the energized conductor.

The rescue worker should stay as far away from the victim or the wire as the hot stick will permit. If additional help and another hot stick are available, they may be employed in the rescue operation. One man may hold the live wire immobile while the other man moves the victim from contact with the wire. This additional assistance can prevent the end of a live wire from whipping in a manner similar to that of an unattended garden hose that is discharging water from an open nozzle. Also, by keeping the wire in contact with the ground, the exposure of a victim to additional shock and burns is kept to a minimum.

In cases where hot sticks are not available, an alternate procedure may be applied.

Use a long, dry rope (of a type referred to in Figure 1) to loop around some part of the victim's body in a manner that will permit dragging the victim from the danger area. This alternate procedure may require the squadman to perform the rescue operation from a position much closer to the victim and/or the wire than the maximum distance allowable when hot sticks are employed. Here the rescue worker must perform this act, taking all necessary precautions to prevent his body or clothing from making contact with the victim's body, or clothing, or the wire itself. These precautions are necessary until the victim has been removed from the danger area. Bystanders should be ordered to remain at least a minimum of one hundred feet away from the victim. This will prevent them from coming into contact with anything which may be energized, thus eliminating the chance of additional victims.

FIRST AID AFTER RESCUE

In cases where artificial respiration is required, it should be started at once after the victim has been released from contact with the wire. Resuscitation should continue until the victim has recovered or until a member of the medical profession has pronounced him dead. The treatment of any burns from electric shock should be the same as that described for any burn case.

Closed-chest heart compression may also be needed. The signs that establish when to start this procedure are described in Chapter XII, "Closed-Chest Heart Compression".

CHAPTER XIX

CUTTING TORCHES

INTRODUCTION

On many occasions, rescue and emergency squads are called upon to rescue victims trapped or confined by metal. The cutting torch provides a method of making an effective rescue. In view of the evident importance of this tool, it is essential that every squadman be familiar with its correct use, with its limitations, and with its care. The following paragraphs provide this information.

CUTTING TORCHES AND EQUIPMENT

The oxy-acetylene cutting torch can be used for cutting steel, wrought iron, and other ferrous metals. The equipment is usually portable. It includes two separate tanks: one for oxygen and one for acetylene. Hose, regulators, gauges, cutting torch, lighter, goggles, extra tips, tip cleaners, wrench, leather gloves, and yellow and white chalk must be included in the equipment.

There are several companies which manufacture good cutting torches and equipment. However, since space is limited, this manual cannot list all of them.

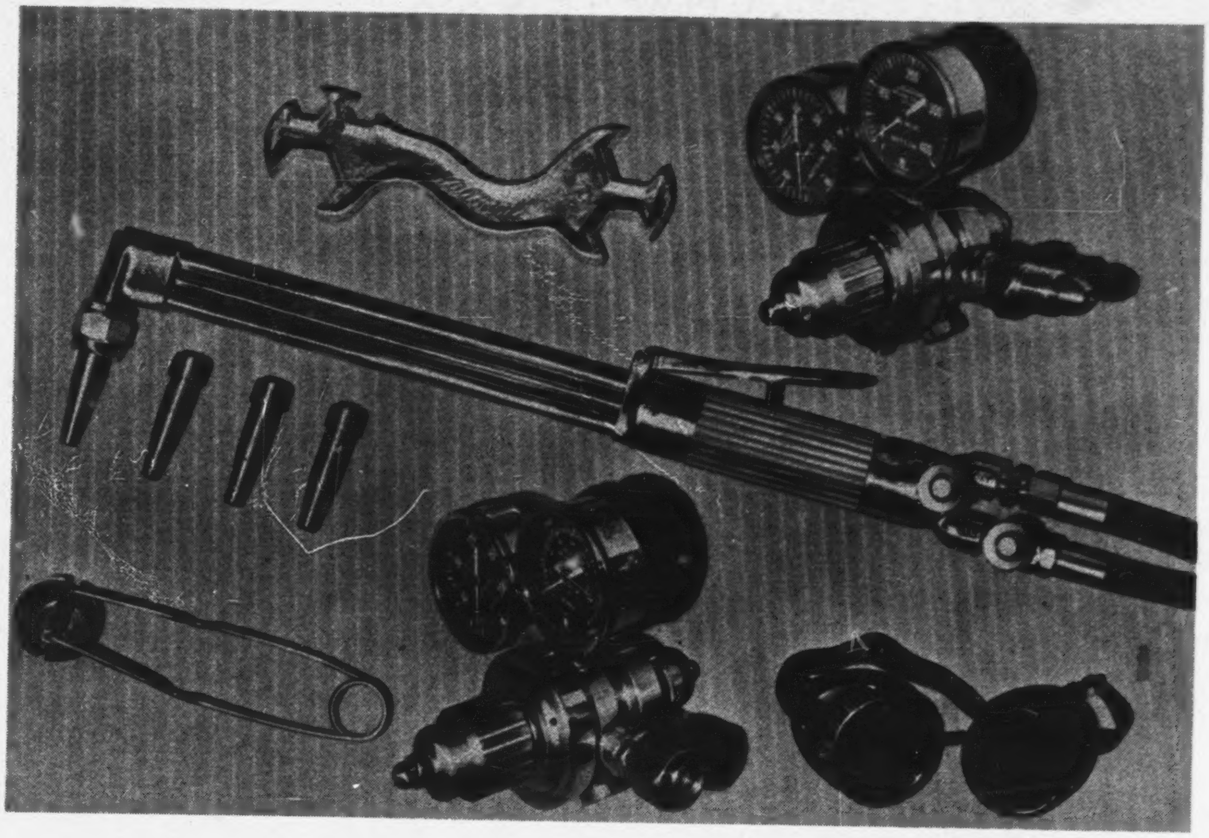
In selecting cutting equipment for the emergency squad, it is advisable to obtain one similar to the assembly shown in Figure 1. This is a sturdy outfit which will cut efficiently and economically. Its tough construction gives it a long life, and it can be used with the small portable tanks.

The complete outfit includes:

1	Cutting Torch (90° head)
4	Cutting Tips, sizes 1, 2, 4, and 6
1	Two-Stage Oxygen Regulator (0-200 lb. and 0-3000 lb., with 2-$\frac{1}{2}$-inch gauges)
1	Two-Stage Acetylene Regulator (0-30 lb. and 0-400 lb., with 2-$\frac{1}{2}$-inch gauges)
1	Wrench (5-way)

RECOMMENDED ACCESSORIES

1	Pair of Goggles
1	Flint Lighter
25'	1/4" Twin Line Hose
4	Hose Connections (2 oxygen and 2 acetylene.)
4	Hose Ferrules



Courtesy National Welding Equipment Co.

Figure 1

Cutting outfit

ASSEMBLING CUTTING TORCH AND HOSE

The cutting torch consists of a handle, or torch body, to one end of which may be attached any one of the various cutting tips, which range in size from 0 to 8. (See Figure 1). On the opposite end are two valves which control the rate of flow of oxygen gas and acetylene gas into the torch. The rubber hoses supplying the two gases are attached to these valves.

The acetylene tanks and hose connections of all makes of torches have left-hand threads. Oxygen connections have right hand threads.

A good wrench should always be used to tighten torch parts and hose connections; never use pliers. It is important to keep the packing nuts fairly tight on the torch valves so that the valve setting does not change while the torch is in use. Always use an open-end wrench. Valves that turn too easily are likely to be accidentally thrown out of adjustment when they brush against something.

OPERATING PRESSURE REGULATORS

The rubber hoses from the torch fasten to two pressure regulators, one regulating the pressure of the acetylene gas in the acetylene hose, and one regulating the pressure of the oxygen gas in the oxygen hose. It is necessary to keep the pressures of the two welding gases constant at all times and low enough not to overload the nose. It must be remembered that the pressure of gases in the cylinders decreases constantly while in use.

By turning the cross bar or handle of either pressure regulator, the desired hose pressure can be obtained. The usual pressures are 10 lbs. of acetylene and 30 lbs. of oxygen. This pressure is shown on the pressure gauge on the regulator. Screwing the cross bar in (clockwise) increases the hose pressure. Both oxygen and acetylene regulators have cross bars with right-hand threads.

Regulators connect directly on the oxygen and acetylene cylinders; a second pressure gauge on each cylinder indicates the pressures within the cylinders.

Some manufacturers of welding regulators provide a small storage space in the center of the cross bars in which are kept extra seats, to be used as replacements as wear occurs inside the regulators.

Two rules, if followed, will greatly prolong the life of regulators. It should be stated here that if the torch "acts up" it is quite possible that the regulators are at fault. First, always screw the cross bars out until they are loose, before opening the cylinder valves which are located on the tops of the oxygen and acetylene cylinders. This prevents the suddenly released pressure from overloading and damaging the delicate valve mechanism inside the regulator. Second, lubricate the threads on the cross bars with beewax occasionally. Never use oil or grease anywhere around a gas welding outfit, that is, on any of the parts of the apparatus itself. Oxygen under pressure will occasionally cause oil to ignite if conditions are just right. Oxygen alone does not burn.

SAFE HANDLING OF OXYGEN AND ACETYLENE CYLINDERS

THE OXYGEN CYLINDER

Commercial oxygen used in cutting is stored in steel cylinders. The manufacture of all commercial oxygen is controlled by the United States Department of Commerce to insure safety. The cylinders are made of seamless steel with a fusible plug near the valve at the top. This plug allows the gas to escape at a safe rate in the event that the cylinder should be subjected to a dangerously high temperature. Oxygen gas is pumped into the steel cylinders to a pressure of about 1800-2000 pounds to the square inch. Cylinders are made in various sizes, the two most common having a capacity of 110 and 220 cubic feet of gas, respectively. The shut-off valves mounted on the tops of the cylinders are of special design because of the extremely high pressure they have to hold. They have a right-hand thread, and when opened should be turned as far as they will go. This prevents leakage by causing the valve to seat in the top of the valve body. Commercial oxygen is usually obtained from air and seems much like air in many ways, since it is odorless, harmless to breathe, and non-inflammable.

THE ACETYLENE CYLINDER

Acetylene gas is stored safely by pumping it into special steel cylinders. It is also controlled in its manufacture by the Department of Commerce. Unlike the oxygen cylinders which have no liquid or solid material whatever inside, the acetylene cylinders are loosely filled with an asbestos absorbent which is saturated with a liquid called acetone. Acetone has the ability to dissolve acetylene gas under pressure. The result is that when 220 cubic feet of acetylene gas is pumped into a cylinder of approximately the same size as the one used for oxygen, the pressure is only 250 pounds to the square inch. This greatly increases the safety of handling and transporting compressed acetylene. The acetone remains in the cylinder as the acetylene is allowed to escape during welding, and is used repeatedly with practically no loss. Fusible plugs in both the bottom and the top of each cylinder are an additional safety factor. The acetylene cylinder valves are not subjected to as much pressure as the oxygen valves and do not require the special sealing feature - the packing used in the valves being ample to prevent leakage. These valves have right-hand threads and should be opened only one and one-half turns to allow for rapid shutting off in an emergency. They require a special square socket wrench which can be obtained from the firm supplying the gas. The diameter of the threaded outlet for the regulator is smaller than that on the oxygen cylinder.

ATTACHING CYLINDERS

Before attaching fresh cylinders of gas to the welding outfit, the valves should be opened slightly and a small amount of each gas allowed to escape. This is called "cracking" a tank. Oxygen will not burn but acetylene will. One should be certain that no open flame is near when the acetylene valve is opened. The escaping gas blows out any dust or particles of grit that may have lodged in the valves during shipment. All fitting must be perfectly clean before screwing them on the cylinders.

As before mentioned, be sure all regulators are in the "off", or loose, position before turning the gas on at the cylinders.

In turning the gas off at the cylinders extreme care should be exercised to make certain the valves are completely closed. The two torch valves should then be opened to "bleed off" the remaining gas in the hose. The pressure regulators should then read zero.

USING THE CUTTING TORCH

All types of cutting torches operate on the same principle and are provided with tips of various sizes for cutting metals of different thicknesses.

In contrast with the welding torch which has a single orifice at the tip, the cutting torch has five or more. The center orifice is for oxygen only, and is supplied with a quick-acting oxygen valve. This central oxygen orifice is surrounded by four or more orifices for the oxy-acetylene pre-heating flames. These pre-heating flames are adjusted independently of the oxygen cutting valve and, once adjusted, keep burning steadily regardless of whether the oxygen cutting valve is opened or closed.

One can use the oxygen cutting torch with excellent results on any kind of steel or wrought iron. Cast iron is somewhat more difficult to cut.

First select a cutting tip of suitable size for the thickness of metal which is to be cut. A tip with an oxygen orifice drilled at the factory with a No. 66 drill is suitable for cutting steel one quarter of an inch in thickness; No. 52 for one inch, and No. 48 for three inch. The larger the wire gauge drill size number, the smaller the orifice.

The torch, valves, and connections should be checked for leaks before the torch is lighted. This can be done by passing the face near and around the torch, valves, and connections. If an acetylene gas leak is present it can be detected by smell. If any oxygen gas leak is present it can be heard or felt blowing upon the face.

Next, adjust the acetylene hose pressure as for cutting.

The oxygen hose pressure required depends upon the tip used and the thickness of the steel being cut, and varies from 10 pounds to 150 pounds. Tables supplied with torches indicated oxygen and acetylene pressure for each tip and thickness of metal to be cut. These pressures vary with different makes of torches and sizes of tips. (See Figure 2)

The oxygen valve on the torch body should be opened far enough to give full oxygen pressure through the torch for cutting. This is an important point for beginners.

Adjust the pre-heating flames to neutral and try the cutting valve to see that full oxygen pressure is feeding through to the oxygen orifice in the tip. It is important also to keep the orifice clean and round.

Cutting TIP SELECTOR CHART—including tip drill sizes

(1) IF . . . . the metal thickness you want to cut is as shown below.	(2) THEN . . . . select the cutting tip size shown on the same line for your model of torch. . . .			(3) SET YOUR REGULATOR . . working pressures as indicated below, in pounds per square inch.		(4) TO KEEP YOUR TIPS CLEAN . . . . use tip cleaners of the correct drill size for each hole or orifice of the various tip types as shown below.				
								Preheating Holes for Types:		
In Inches	400	300 310	210	25	Oxygen	Acetylene	Center Hole All Types	AA-D	AS	SC	Others
1/16 to 1/2	0	0	0	0	10-20	3	60	73	66		63
1/8 to 3/4	1	1	1	1	15-30	3	57	72	65		62
1/4 to 2	2	2	2	2	15-50	5	54	70	64		61
1/2 to 4	3	3	3	3	20-60	5	51	68	63	66	60
2 to 6	4	4	4		30-70	5	46	66		61	59
4 to 8	5	5	5		60-80	8	42	64			58
6 to 10	6	6			70-100	8	37	61			57
8 to 12	7				100 and up	10	32	58			56
10 to 14	8				150 and up	10	30	56			55

(1) The most desirable metal thickness to be cut by any given tip size will depend partially upon the condition of the metal surface and how advanced your skill in flame cutting.

(2) Select that cutting tip size and type which gives YOU the best results. Do not use larger tip size than that recommended for your model of torch.

(3) The wide latitude of suggested Oxygen pressures for each tip size is related to the thickness to be cut. The highest pressure, of course, for the thickest metal. Here, too, the oxygen pressure will depend greatly upon your skill, surface condition and type of ferrous metal to be cut, and how WELL you handle the cutting starting time.

(4) A clean cutting tip will do much better work for you than a neglected one. Suitable tip cleaners will keep your tips at top operating efficiency. Wire and make shift methods may damage the tip ports. Make your tips cut cleaner over a longer period by taking good care of them. Neglect costs money.

Figure 2

Courtesy National Welding Equipment Co.

Cutting tip selector chart

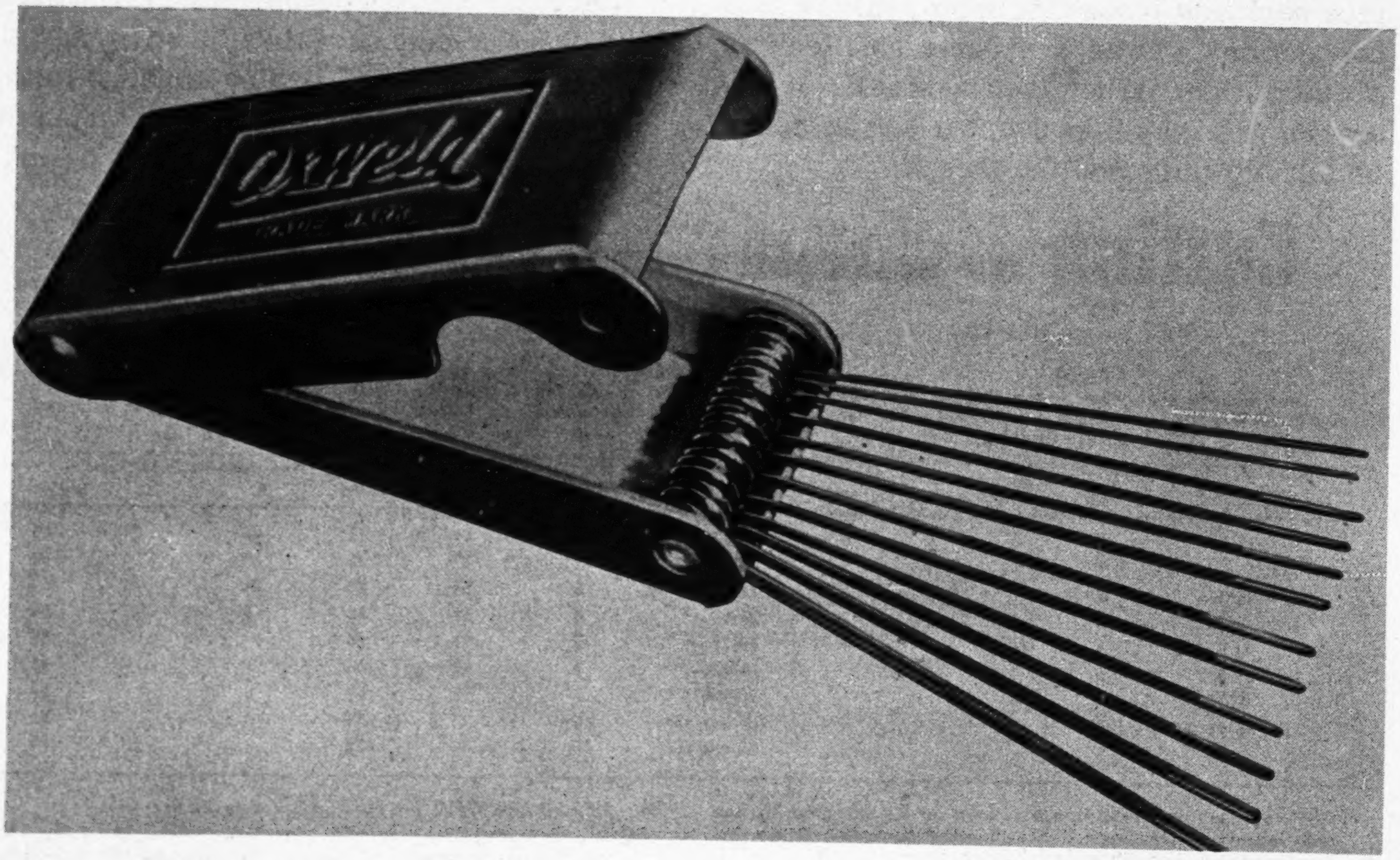
Tip cleaners of correct size should be used. Slag that sticks to the end of the tip can be loosened with pocket knife without damaging the tip. If the flames do not burn properly, shut them off and clean the tip. Figure 3 shows tip cleaners.

With the luminous pre-heating cones of the cutting tip just touching the steel to be cut, heat the edge or other point where the cut is to begin. Be sure to have the torch well supported and pointed at the work.

When the steel begins to melt, the cut can be started by slowly pressing down the cutting-oxygen-valve lever.

During the cut the tip of the torch should be kept at a constant distance from the work. This will vary from 1/16 inch to 3/16 inch depending upon the thickness of the metal. This gap should not change as the torch is moved along the cutting line. The bottom of the kerf or cut should be kept a little ahead of the top.

It is important to move the torch at a uniform speed and at a speed which is slow enough to allow the oxygen to cut all the way through. In turning off the gas at the cutting torch, the acetylene should be turned off first.



Courtesy Linde Co.

Figure 3

Tip cleaners

CARE OF CUTTING TORCHES

Following is a list of safety precautions in using and maintaining the equipment:

1. Always use a good wrench to tighten torch parts and hose connections.
2. Never use oil or grease on any part of the torch or tanks.
3. Always check tank, hose and torch for acetylene leaks before lighting torch.
4. Be sure all regulators are in off position before turning on the gas cylinders.
5. Hose and equipment should be kept free of oil or dirt.
6. Caution should be taken to protect hose from being cut by glass, sharp metal, or hot molten metal.
7. Keep torch in box provided for its storage.
8. Check hose for deterioration.
9. See that goggles are not broken and are clean.
10. Inspect tanks frequently for leaks, and also to see that pressure is maintained.

RESCUE PROCEDURE

Care must be taken to protect the victim from the dangers of heat, smoke, and burns which he might receive from the flame, torch, molten metal or sparks. A fire-resistant, or wet blanket is very useful for protecting the victim from these dangers.

The operator of the cutting torch should wear heavy leather gloves for protection.

A squadman should be assigned to stand by with the proper extinguisher (do not use carbon tetrachloride) or hose line, during cutting operation, to protect people and property.

Thorough inspection should be made after the victim has been removed, to make sure all fire and sparks have been extinguished.

As portable tanks will contain only enough gas to cut for a limited time, it is a good policy to have a list of owners of larger tanks that can be made available for long cutting operations.

The following staged pictures show steps and proper precautions in the use of oxy-acetylene cutting equipment for freeing accident victims.

SITUATION

There is an automobile wreck and the victim's left foot is trapped in the wreckage. Figures 4 through 7 show the rescue procedure.

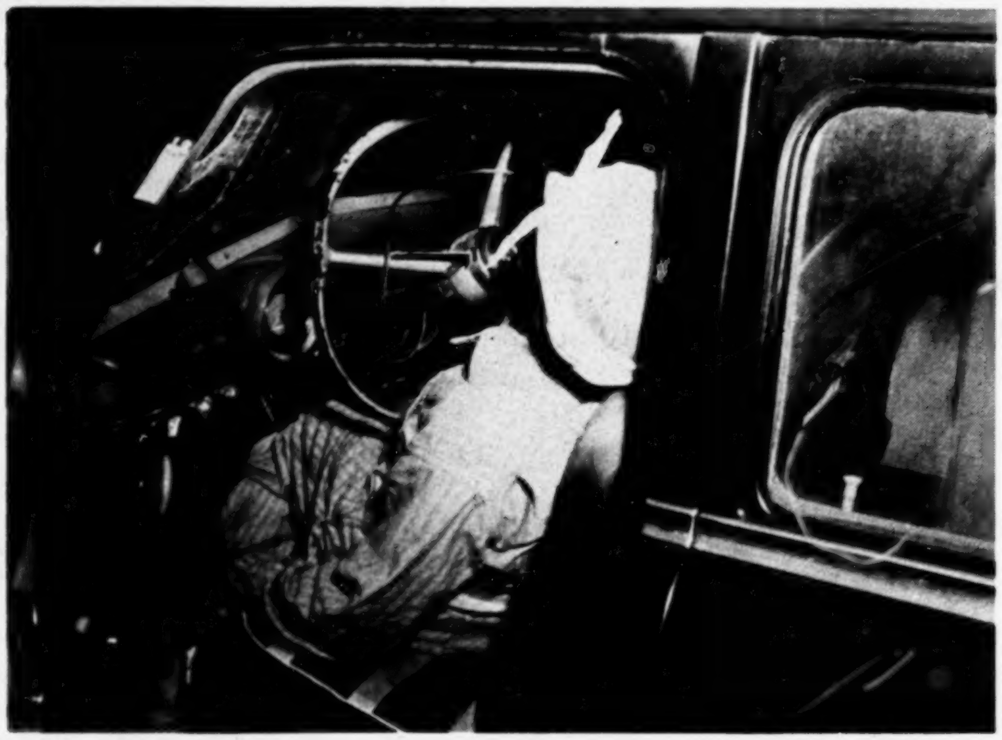


Figure 4

A compress has been applied to the victim's head to stop bleeding.

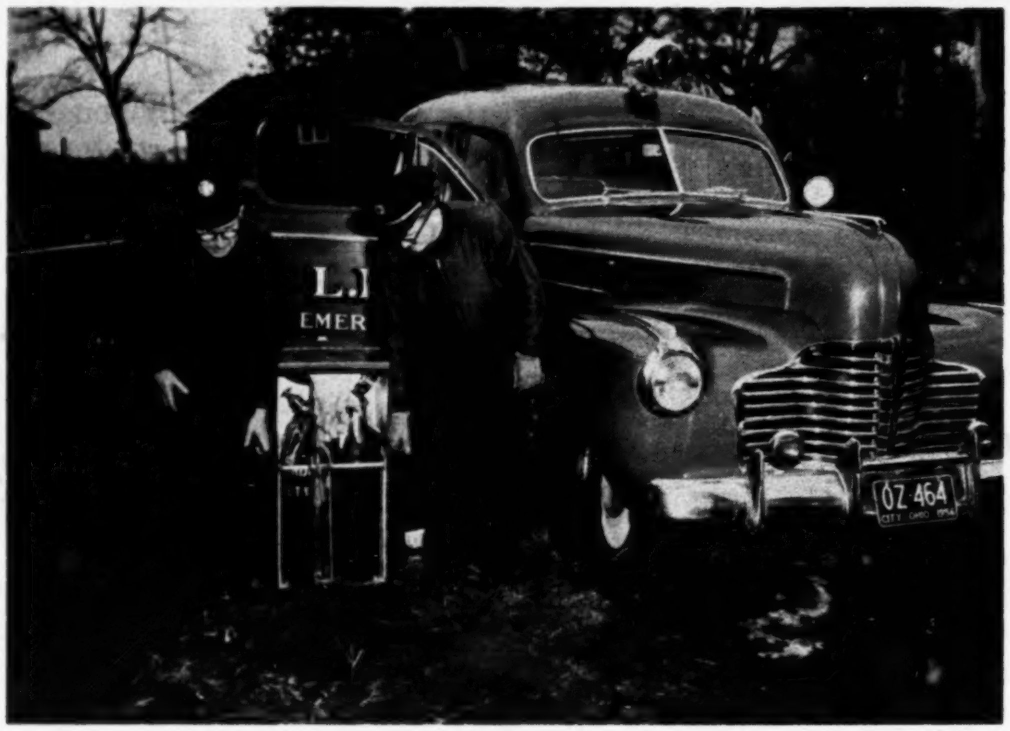


Figure 5

A portable cutting torch is obtained from the squad car.

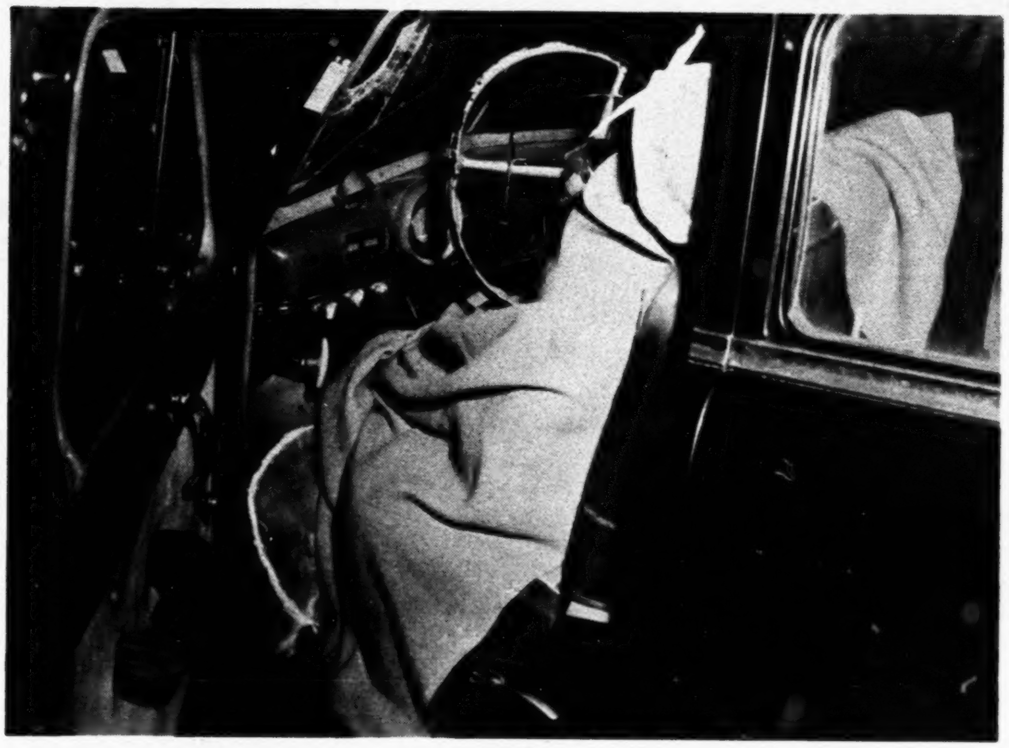


Figure 6

The victim is covered with an asbestos blanket and a chalk mark is drawn where the cut is to be made.

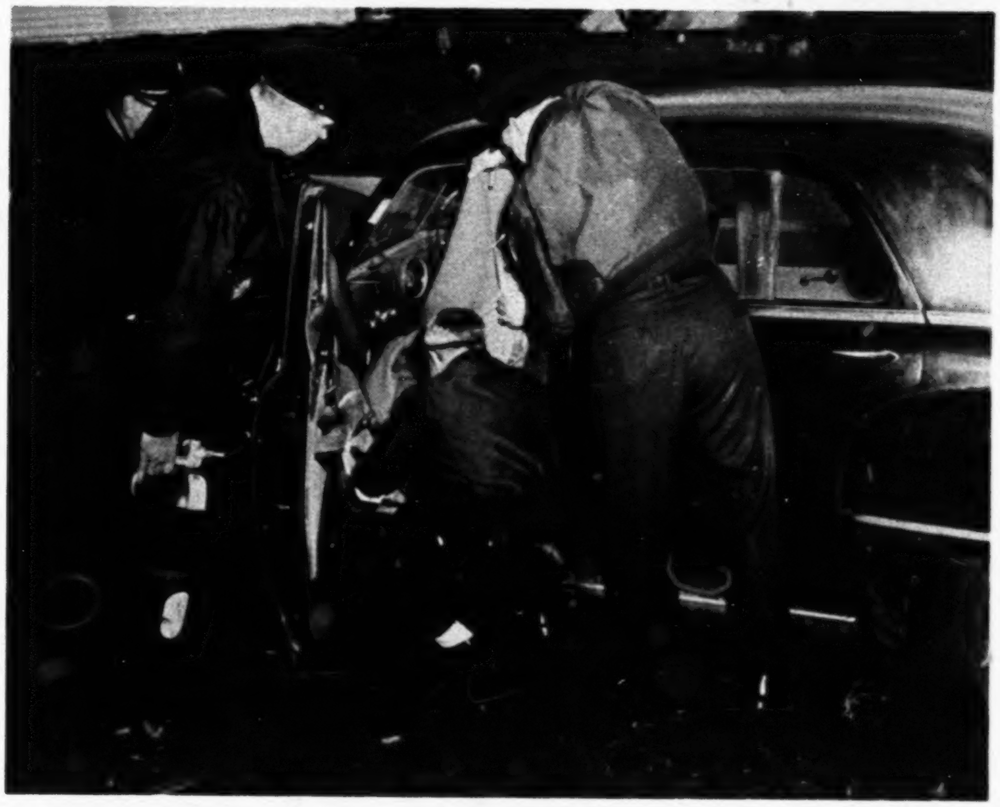


Figure 7

Squadman No. 1 cuts with the torch. Squadman No. 2 stands by with an extinguisher. Squadman No. 3 holds a blanket over the victim's head to prevent breathing of fumes and smoke. Squadman No. 4 supervises the operation.

CHAPTER XX

ROPE AND RIGGING

INTRODUCTION

Rigging is essential to many rescue operations which necessitate lifting or hoisting. It is imperative that rescue personnel know how to use ropes, cables, blocks, ladders, gin poles, and other rigging equipment in rescue operations. Mastery in the use of ropes and rigging can come only after much practice and drill. This chapter describes basic rigging equipment and explains some applications.

Rescue equipment is always carried on heavy rescue vehicles. However, light rescue vehicles also should carry the basic equipment for hoisting and lowering victims.

ROPE

Although rope is made of different fibers, manila, sisal and hemp are used most extensively. In rope-making, fibers are first twisted together to make a yarn. The yarns are then twisted together to make a strand and the strands are twisted together to make a rope. Reversing the twist in every step of building up a rope locks it together. The twist in one direction offers an equal resistance to the twist in the opposite direction, which balances the rope and keeps it in proper shape. The direction of twist is indicated by the terms "left hand" and "right hand" or, "with the sun." To determine the direction of twist, face and point a portion of the yarn or strand of rope toward the sun. If the direction of twist is the same as that of the sun's motion it is said to be "right hand" or "with the sun," but if it is in the opposite direction it is said to be "left hand."

Rope has a tendency to untwist and lengthen if a weight is suspended from its end. Because of this tendency, it is recommended that new rope be hung from a tower for several days with sufficient weight attached to stretch it before use. This stretching can be done by fastening the top end with a clamp, then attaching a weight to a clamp at the lower end of the rope. This does away with the kinking that would result if knots were tied in the rope itself.

See Figure 1a and 1b. Rope may also be straightened by having a man walk back and forth around two stationary poles, dragging the rope until it straightens out. See Figure 1c.

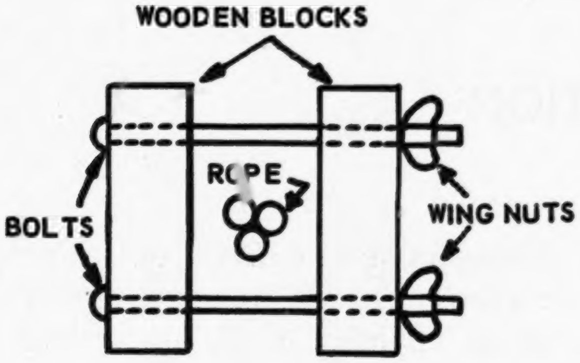


Figure 1a

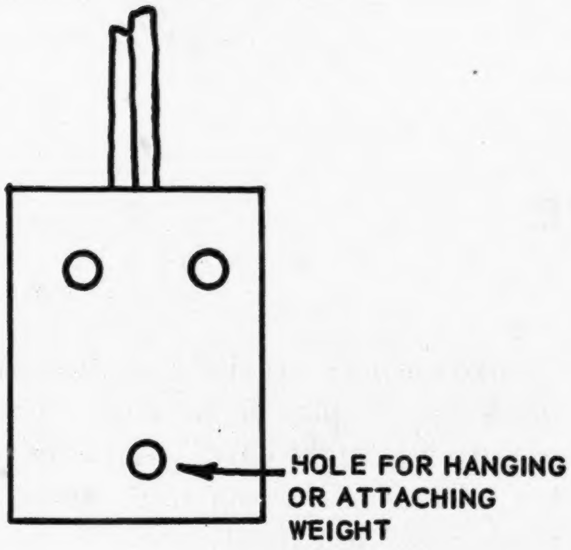


Figure 1b

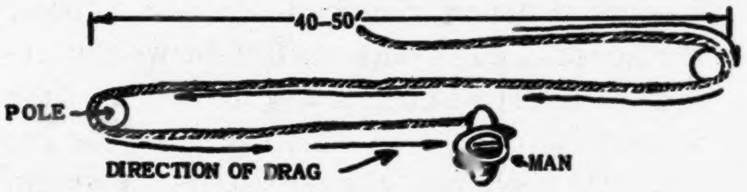


Figure 1c

Straightening and stretching the rope

A rope so treated will handle much easier when put into actual service. Figure 2 shows the manner in which this tendency to untwist and lengthen is overcome. A number of fibers are twisted in a "right hand" direction as shown at C. From two to twenty yarns are formed "left hand" into a hawser-laid rope as shown at A. In each of these successive steps, the twisting has been in opposite directions. As soon as the rope, as a whole, begins to untwist, the individual strands forming it are twisted tighter. The rope can untwist only far enough to bring those opposing forces to an equilibrium.

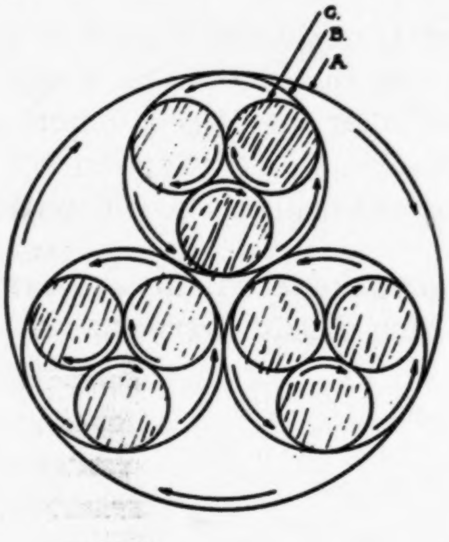


Figure 2

Twisted rope

TYPES OF ROPE

Three strands laid up in a "right hand" direction, as shown in Figure 3, form a hawser-laid rope. Four strands laid up in a "right hand" direction, having a central core as illustrated in Figure 4, form a shroud-laid rope. Three hawser-laid ropes laid up in a "left hand" direction form a cable-laid rope.

Most of the rope used in rescue work is hawser-laid. The principal use of shroud-laid rope is for power transmission. Larger ropes used in well drilling and mining are cable-laid.

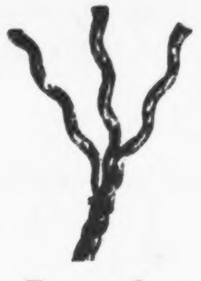


Figure 3
Hawser laid rope

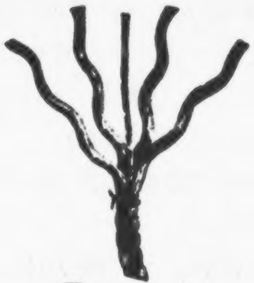


Figure 4
Shroud laid rope

SIZE OF ROPE

Rope of all kinds is usually described by giving its diameter in inches. Rope is purchased by giving the diameter and the number of feet desired but is sold by the pound. The size of a given type of rope is varied by changing the number of yarns in a strand.

STRENGTH OF ROPE

In choosing rope for a given purpose, a large measure of safety should be used. As an example, to elevate 775 pounds at a time, do not select a rope with a maximum or breaking strength of 775 or even 1,000 pounds but rather one with about seven times this amount of breaking strength.

Figure 5 shows the breaking strength of a new 7/8" manila rope to be 5,440 pounds. One-seventh of 5,440 pounds is 777 pounds, or about the same as the load to be lifted. Therefore, a 7/8" rope is the proper size for the present problem.

For a new manila rope, the breaking strength in pounds may be roughly calculated as follows: Square the diameter in inches and multiply the product by 7,200. The safe load can be found by dividing the breaking strength by seven.

Exposure and wear are the most important factors in deteriorating the strength of rope and a liberal allowance should be made for both when estimating the strength of old rope for any purpose.

Diameter, in inches	Circumference, in inches	Weight of 100 feet, in pounds	Length of Each Pound in feet & inches		Safe Load, in pounds	Breaking Load, in pounds	Diameter of Pulley, in inches
3/16	9/16	2	50	0	35	230	1-1/2
1/4	3/4	3	33	4	55	400	2
5/16	1	4	25	0	90	630	2-1/2
3/8	1-1/8	5	20	0	130	900	3
7/16	1-1/4	6	16	8	175	1240	3-1/2
1/2	1-1/2	7-2/3	13	0	230	1620	4
5/8	2	13-1/3	7	6	410	2880	5
3/4	2-1/4	16-1/3	6	1	520	3640	6
7/8	2-3/4	23-2/3	4	3	775	5440	7
1	3	28-1/3	3	6	925	6480	8
1-1/8	3-1/2	38	2	7	1260	8820	9
1-1/4	3-3/4	45	2	2	1445	10120	10
1-3/8	4-1/4	58	1	8	1855	13000	11
1-1/2	4-1/2	65	1	6	2085	14600	12
1-3/4	5-1/4	97	1	0	3070	21500	14
2	6	113	0	10	3600	25200	16
2-1/2	7-1/2	184	0	6-1/2	5630	39400	20
3	9	262	0	4-1/2	8100	66700	24

Figure 5
Facts about three strand manila rope

INSPECTION OF ROPE

A length of rope may appear badly worn on the outside and still be much better than another length which looks good on the surface. Chafing occurs in rope; the inner fibers rub or chafe against each other, especially where a rope bends when going through a pulley. Many of the central fibers become broken into dust and short pieces. Because of this, rope should be checked each time after being used, for this check may save a life. In view of the many conditions that can affect the strength of rope, and since only a part of the rope may be affected, an examination of the entire length should be made at least once every six months.

If, upon examination, any of the following conditions are found to exist, and if the condition of the rope is such that there is any doubt as to its being safe to use, the condition should be reported to a superior officer.

On the surface of the rope:

1. Abrasions (broken fibers)
2. Cuts
3. Extreme softness (badly worn rope is extremely soft and has lost its stretch)
4. Decay or burns (caused by high temperatures or chemicals)

To examine the inside of rope, separate the strands at three-foot intervals and observe the inner parts for:

1. Broken fibers
2. Fine powder (indicates the presence of grit)
3. Mildew or mold
4. Change in color of the fibers

Rope should not be carried in a truck compartment that is damp or contains sharp-edged tools. It must always be carried coiled, ready for use.

USE OF ROPE

Because rope is such a necessary and important item of equipment, it should be carried on all apparatus. The number of ropes, and size, will vary according to the squad's requirements. Generally, the sizes vary from one-quarter inch to one inch and the length from 100 to 150 feet.

Among the purposes for which rope can be used to good advantage are:

There are a number of purposes for which rope can be used to good advantage, some of which are:

1. To hoist ladders, tools and appliances
2. As a life line in rescue work
3. To aid in maintaining bystander lines
4. To lash ladders together to extend the length
5. For wrecking operations
6. As guy lines when hoisting equipment or patients

KNOTS, BENDS AND HITCHES

A knot is a knob in a piece of rope which serves as a stopper or a button and is formed by interweaving the rope. A bend is a method of fastening one rope to another, to a ring or to a loop, etc., by passing the rope through a loop and fastening it back upon itself. A hitch is a temporary knot or noose with which a rope is fastened around a timber, pipe, or post in such a manner that it can be easily untied. These definitions or distinctions are very loose in their application, and it should be remembered that most of the knots ordinarily used are, strictly speaking, bends.

Knots stay tied due to the frictional resistance of the rope which prevents its parts from slipping and thus untying the knot. A knot or hitch must be so devised that the taut part of the rope bears on the free end in such a manner as to pinch and hold. In a knot, the free end is held against another part of the rope; in a hitch, against the object to which the rope is attached.

The usefulness of a knot should be judged by the following essential factors:

1. Rapidity with which it can be tied
2. Ability to hold fast when pulled tight
3. Ease with which it can be undone

In forming knots, bends and hitches, the rope used assumes the following shapes which are described as the "round turn," the "open bight" or "loop," and the "bight" as shown in Figures 6, 7, and 8, respectively.

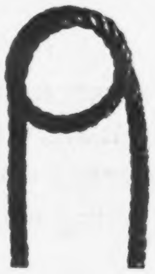


Figure 6
Round turn

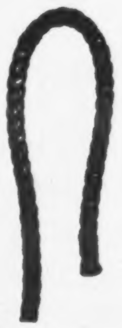


Figure 7
Open bight or loop

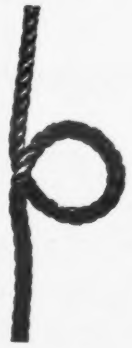


Figure 8
Bight

EFFECT ON THE STRENGTH OF ROPE E

Rope has its maximum strength when the strain from a load is applied evenly to all fibers. When a knot is tied in a length of rope, the weakest part of the rope is at the knot. In all knots, some more than others, the rope is cramped or has a very short bend which throws an overload on those fibers that are on the outside of the bend. This causes the fibers to break, and the rope may eventually part. The shorter the bend, the less the tensile strength of the rope.

The following list shows the decrease in tensile strength according to various knots:

1. Square knot - 50% loss
2. Bowline - 40% loss
3. Clove hitch - 35% loss
4. Short splice - 20% loss

WHIPPING THE END OF THE ROPE

The end of a rope that is to pass through pulleys or other small openings should be finished by whipping. The whipping is done with a very stout linen or cotton cord as follows: Make a loop in one end of the cord, hold the loop along the rope as shown in Figure 9a, and wrap the long end B of the cord tightly around the rope in the same direction in which the strands are twisted, as in Figure 9b. When within about ½ inch of the end of the rope, slip the end of B cord through the loop, as shown in Figure 9c. With the end A, pull the loop beneath the whipping as far as possible, as shown in Figure 9d. Both ends may now be cut close to the rope. The finished end is shown in Figure 9e.

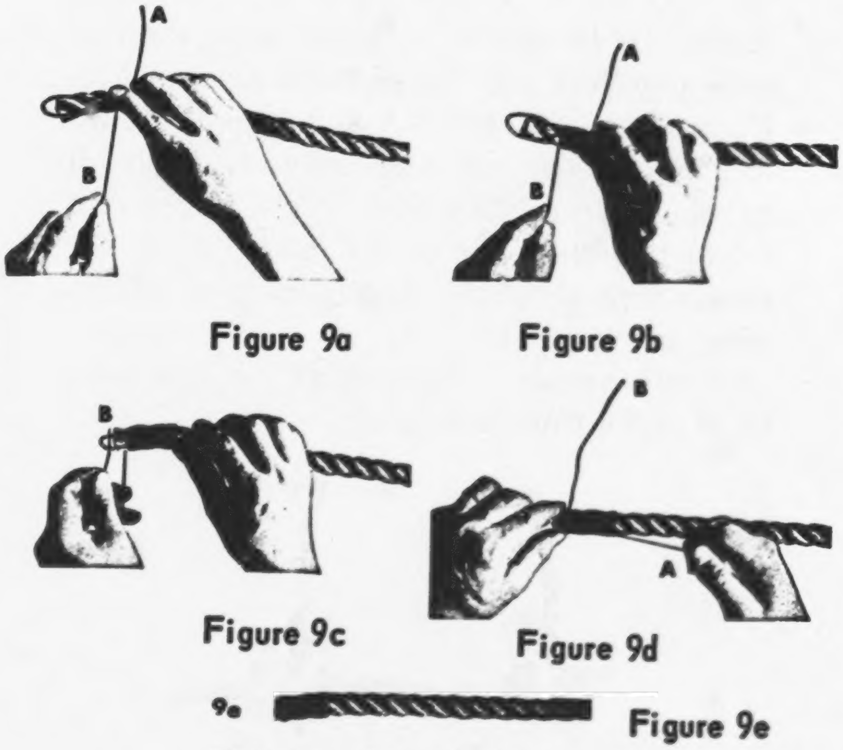


Figure 9a **Figure 9b**

Figure 9c **Figure 9d**

Figure 9e

Whipping the end of the rope

THE HALF HITCH

Of all the hitches, the "half-hitch" is most widely used, both alone and in combination with a variety of other knots. It is very easy to make. As shown in Figure 10, the rope is fastened to a timber by a single half-hitch. In tying the half-hitch, the free end of the rope is brought around the tension end and then brought under itself.

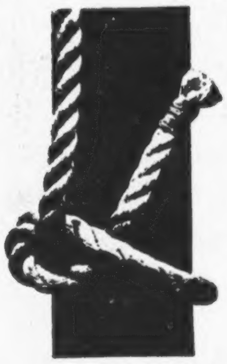


Figure 10
Half hitch

THE SQUARE KNOT

The square knot is used in tying two ropes of the same size together. It will not slip when drawn tight and is easily untied. It is tied as follows: Bring the two ends together and cross them as shown in Figure 11a. Place end A across B as shown in Figure 11b, and then move A around B as shown in Figure 11c. Care should be taken that the knot is tied and assumes a final shape as shown in Figure 11d; otherwise a granny knot rather than a square knot will result. See Figure 12. Be sure to observe this difference.

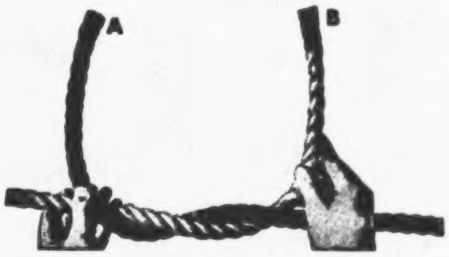


Figure 11a
First step in tying a square knot

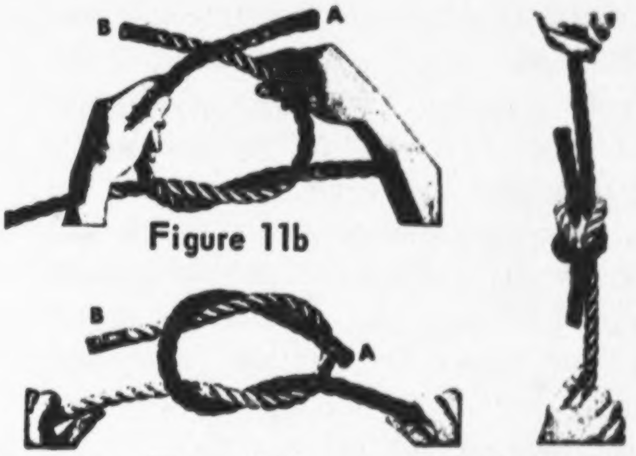


Figure 11b

Figure 11c **Figure 11d**
Completing a square knot

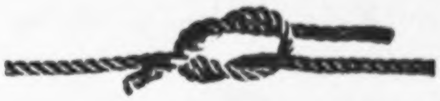


Figure 12
Incorrect square knot (granny knot)

THE CLOVE HITCH

The clove hitch is used to fasten a rope to a stake, pipe or post. It is a hitch commonly used for raising or lowering small equipment. It may be tied by using either of the following two methods:

First Method - Give one end of the rope two turns around the post, cross over the long portion and place the short end beneath the second turn, as shown in Figures 13a and 13b.

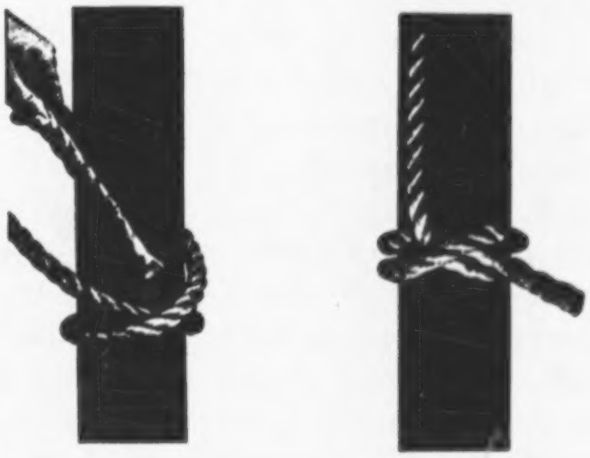


Figure 13b **Figure 13a**
Clove hitch around post

Second Method - Throw one bight in the rope to the right and another to the left, as shown in Figure 14a. Move bight A over on bight B as indicated by the arrow and shown in Figure 14b. Place the hitch over the end of the object and pull the long end in any direction.

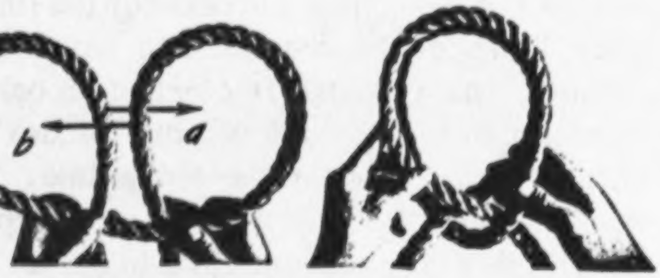


Figure 14a Figure 14b

Slip-over clove hitch

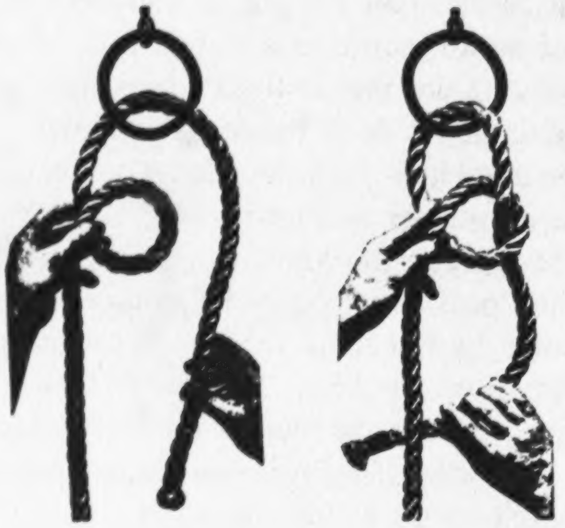


Figure 15a Figure 15b

First steps in tying a bowline knot

THE BOWLINE

The bowline has been rightfully called the king of knots. See Figures 15a - 15e. This knot is probably used more than any other, for it never slips and is always easily untied. It can be used wherever a loop is desired in the end of a rope. It may be tied as follows: Place the end of the rope through a ring or around an object. Throw a bight, having the long portion of the rope on the side of the bight nearest you, as shown in Figure 15a. Move the end of the rope through the bight in the direction shown in Figure 15b. Bring the end of the rope around the long portion, as shown in Figure 15c. Next, push the end of the rope up through the bight, as illustrated in Figure 15d. The finished knot is shown in Figure 15e.

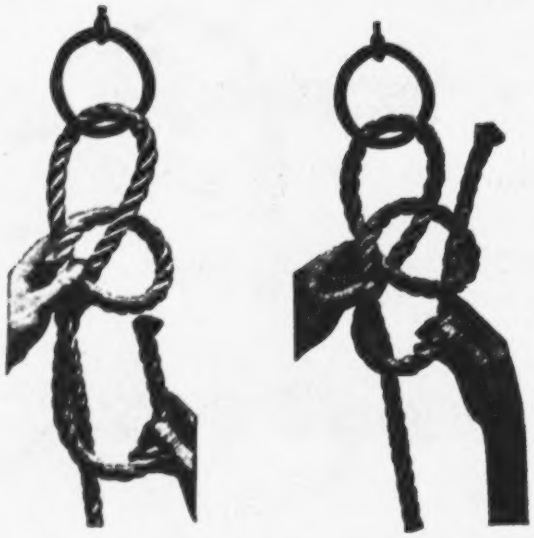


Figure 15c Figure 15d

Completing a bowline knot

THE BOWLINE ON A BIGHT

The bowline on a bight is used to form a loop at some point on a rope other than at the end. Like the ordinary bowline, it is easily untied. It is made as follows: Tie an overhand knot in a doubled portion of the rope, as shown in Figure 16a. Bring the loop back over the knot, as shown in 16b, and then pull the loop out through the knot as shown by the hand in 16c. The finished knot is shown in 16d. This knot is extensively used for rescue work and also to form a saddle sling for lowering men into manholes and similar places.

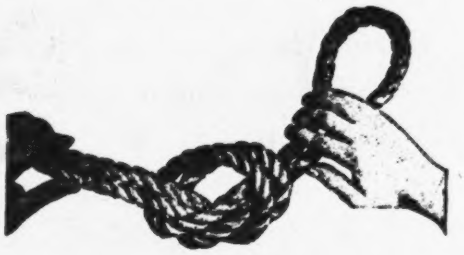


Figure 16a

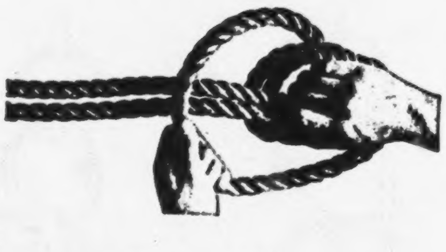


Figure 16b

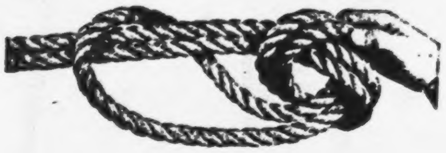


Figure 16c

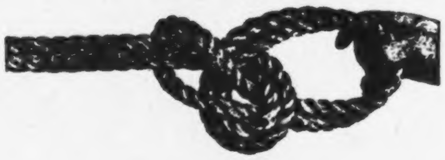


Figure 16d

Bowline on a bight

THE CHIMNEY HITCH

The chimney hitch, shown in Figure 17, is used to obtain a tight line, or to rescue objects. It is made as follows: After the free end of the rope is passed around an object, it is brought back alongside the standing line. The free end is then passed over the standing line and between the lines. This is repeated, but on the third time around, the free end is cinched in behind the first turn. A "safety" or "binder" is then put out in front on the single line. The entire knot, thus formed, can be slipped along the main rope to take in or let out slack; it will hold its position wherever it is set.

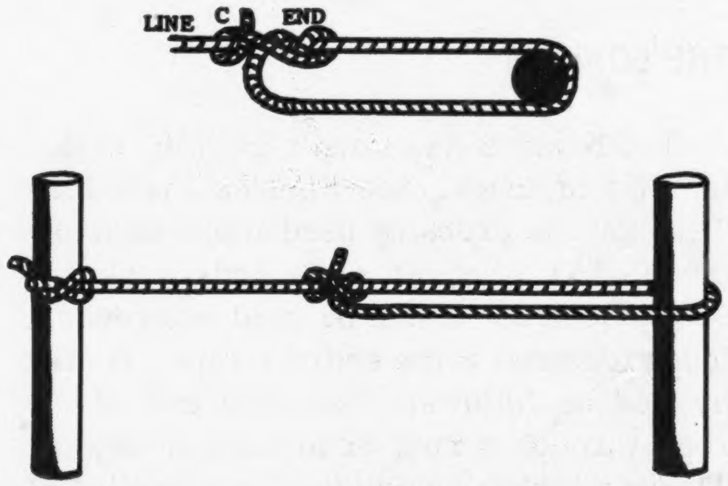


Figure 17

Chimney hitch

THE SHEEP SHANK

The sheep shank, shown in Figure 18, is a hitch used to temporarily shorten or strengthen a defective section of rope. It is tied in the following manner: Make two loops in the rope as shown in Figure 18a. Make a bight in the main part of the rope near the loop A. Push A through this bight, as shown in Figure 18b. Likewise, make a bight in the main part of the rope near loop B, and push B through this bight. The complete hitch is shown in Figure 18c.

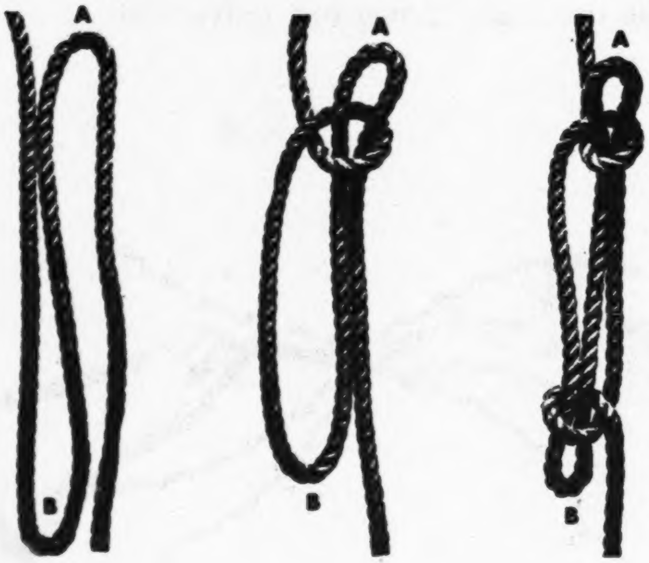


Figure 18a Figure 18b Figure 18c
Sheep Shank

THE BECKET KNOT

This tie is usually used to fasten two ropes of different sizes together. The procedure is shown in Figure 19. Make an open bight with large rope A. Take small rope B around back of rope A, bring rope B over rope A, and pass beneath original rope B. Draw knot tight.

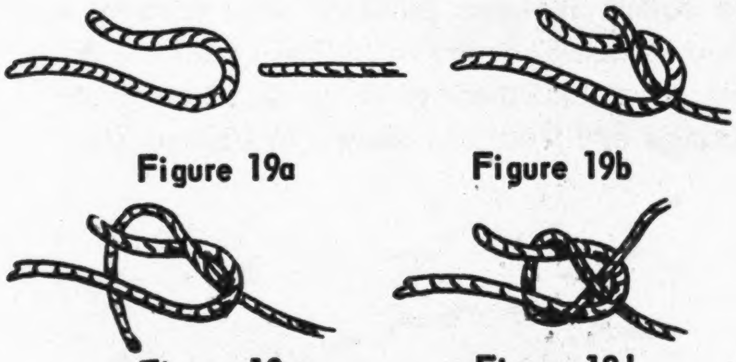


Figure 19a Figure 19b
Figure 19c Figure 19d
Tying a Becket knot

ROPE SPLICING PRINCIPLES AND TECHNIQUES

It has been found that a rope that breaks usually has weak spots other than at the point at which it broke. Rope that has become weakened in small areas can be reclaimed by removing the weak portion and splicing the remainder together. Only in case of dire need should a rope be spliced for use in the rescue service. For general use, other than for emergencies, ropes may be spliced.

This section describes how to follow the principles of rope splicing:

1. Unlaying the strands
2. Placing the ends together
3. Tucking the ends of the strands

In the short splice, the long splice, and spliced crown, the ends of the strands are tucked in exactly the same way. Therefore if the making of one splice is mastered, the others are easily learned.

THE SHORT SPLICE

Where it is not necessary for a rope to pass through a small pulley, or where only a small amount of rope can be spared for making a splice, the short splice is very satisfactory as it is as strong as the long splice. The method of making it is as follows: Count seven turns of the strands from the ends to be spliced and tie strings around the ropes at these points. One turn of a rope is that part shown in Figure 20a at A. Unlay the ends back to the points where the strings are tied, as shown in Figure 20a.

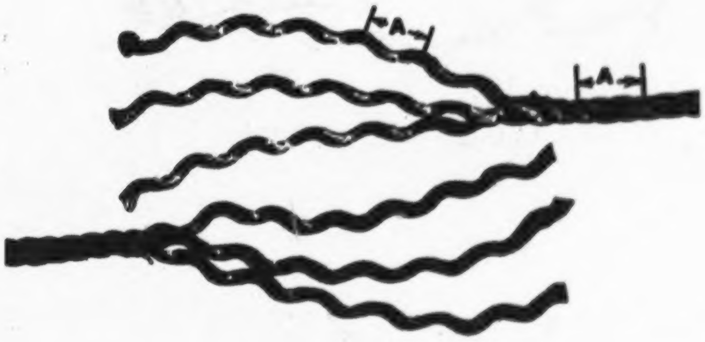


Figure 20a

Before placing the two parts together, be sure to open each end as shown in Figure 20b and not as shown in Figure 20c.

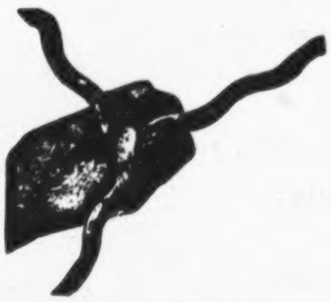


Figure 20c

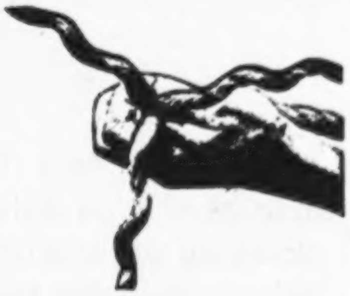


Figure 20b

Bring the two parts together so that each strand of one part alternates with a strand of the other as shown in Figure 20d.

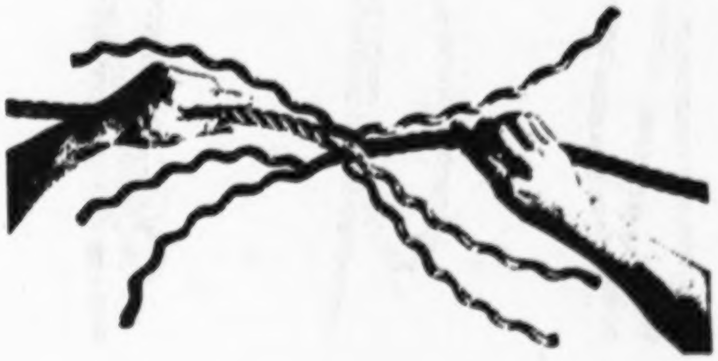


Figure 20d

With a string, tie one set of strands around the rope, as shown in Figure 20e at A.

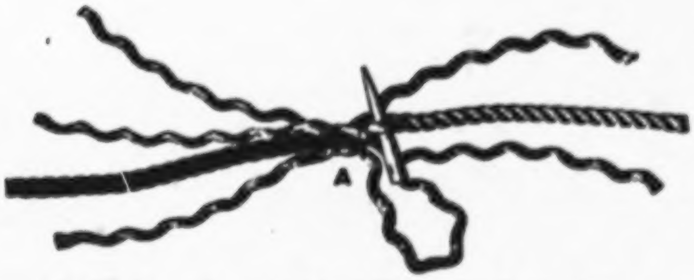


Figure 20e

Next, begin tucking the strands from the left side by bringing a strand from the right side down under the next, as shown by the marline spike in Figure 20e. The tucking should be done at right angles to the direction of twist in the rope.

Give each of the other two strands from the left side one tuck in exactly the same manner. The splice should now appear as shown in Figure 21a.

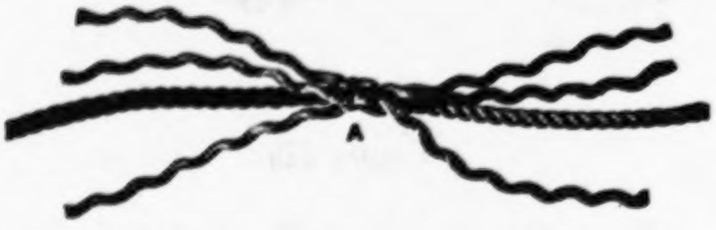


Figure 21a

Next, cut the string shown in Figure 21a at A and give each strand from the right side one tuck, just as was done with the strand from the left.

Figure 21b shows all the strands tucked once. Give each of the six strands two more tucks, always remembering to bring the strand to be tucked over the one nearest to it and under the second, in a direction about at right angles to the direction of the twist in the rope.

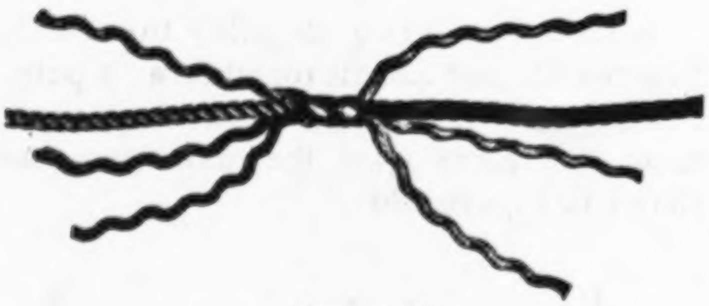


Figure 21b

Next, divide each strand into two parts, as shown in the left of Figure 21c. Give one part of each strand two more tucks.

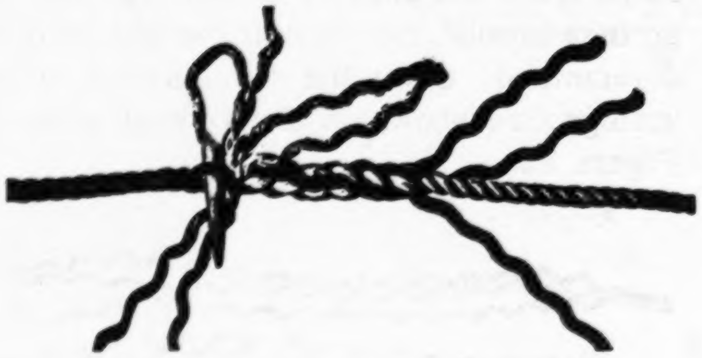


Figure 21c

Cut all the ends off and roll the splice beneath the foot on the floor or between boards to give it a smooth appearance. The finished splice should appear as shown in Figure 21d.

Figure 21d

THE LONG SPLICE

The long splice is more desirable than the short splice when it is necessary for the rope to pass through small pulleys. It also has a neater appearance. To make a long splice in a three-strand rope, count fifteen turns from the ends to be spliced and tie strings around the rope at the points thus determined. Unlay the strands back to the strings, as shown in the lower part of Figure 22a.

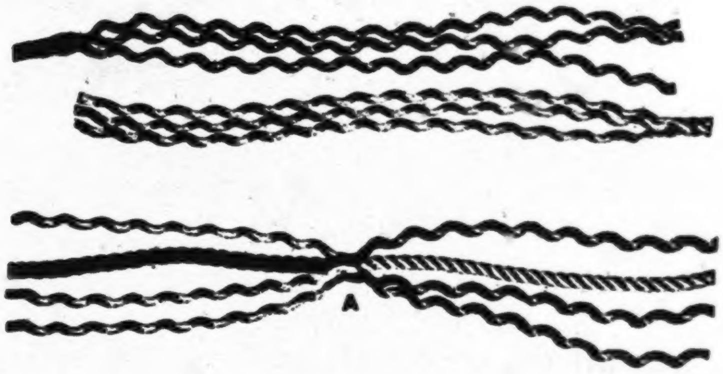


Figure 22a
Long splice

Before bringing the two parts together, be sure to open each end as shown in Figure 21b of the short splice and not as shown in Figure 21c; that is, no strand should cross between the other two.

Bring the two parts together, making each strand from one end alternate with a strand from the other, as shown in Figure 22a at A.

Next, beginning at the point where the two parts are placed together, unlay one of the strands to the right. Lay carefully in its place the corresponding strand from the left. This latter operation should follow closely the unlaying of the strands to the right. Stop at five turns from the end of the strand from the left, as shown in Figure 22b at B.

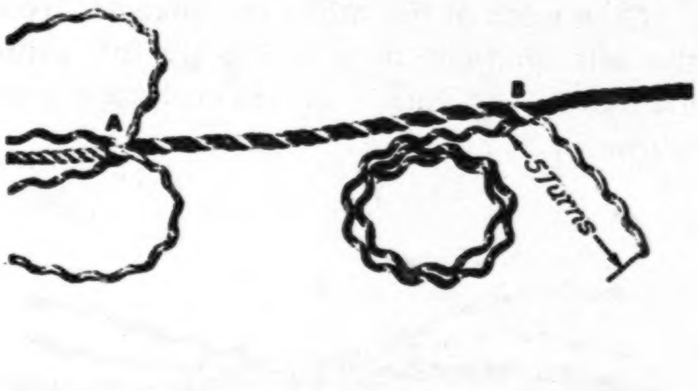


Figure 22b

There are still two pairs of strands left at point A where the two ends were placed together. Run one of these pairs to the left exactly as the first pair was run to the right. This is shown in Figure 22c at C.

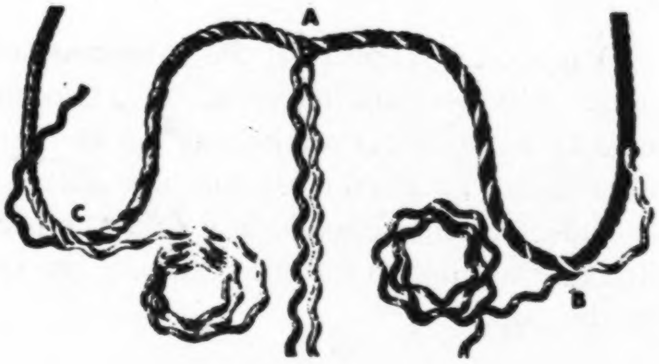


Figure 22c

Before starting to unlay toward C, Figures 22c and 22d fit together as a pair. Next, cut off all the long ends of the strands about five turns from the main rope, as shown in Figure 22d.

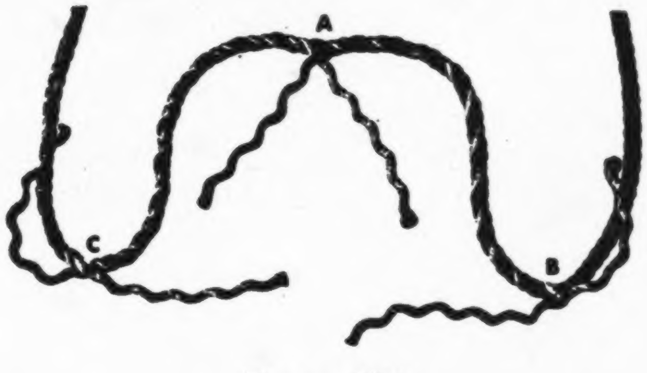


Figure 22d

The next part of the splicing consists of tucking the ends of the strands. There are three strands. All are tucked in exactly the same way, which is as follows: Be sure that the ends of the strands pass each other as illustrated in Figure 22e at A and not as at B.

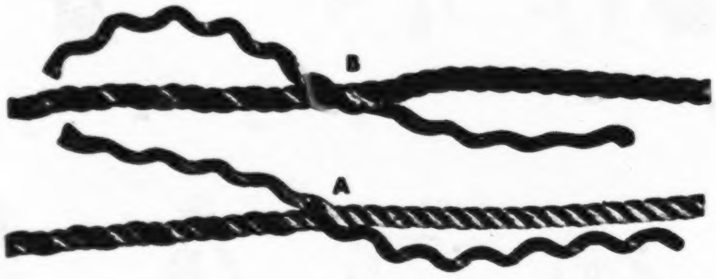


Figure 22e

Bring the strand from the right up over the nearest strand from the left and under the next strand, as in Figures 22f and 22g.

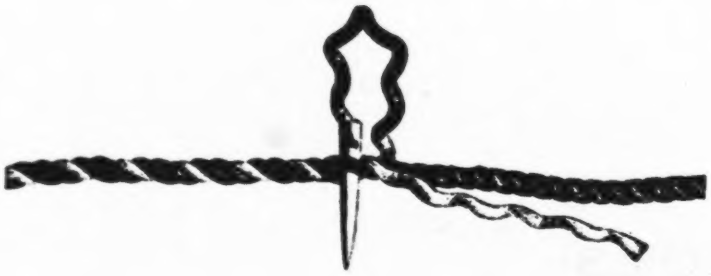


Figure 22f

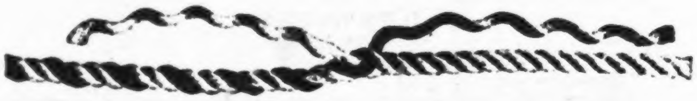


Figure 22g

Give the strand from the left one tuck, as shown by the marline spike in the upper part of Figure 22h.

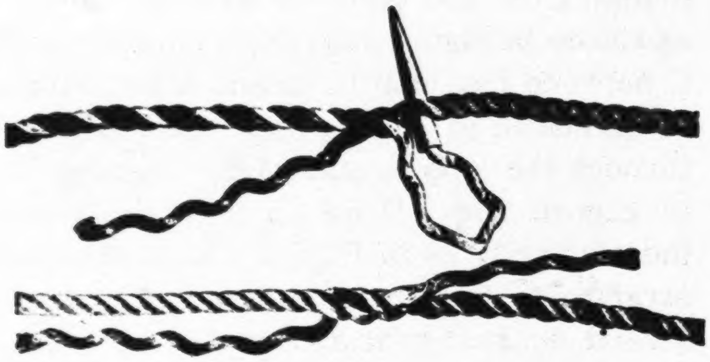


Figure 22h

Each strand should now be given two more tucks in a direction almost at right angles to the direction of twist in the rope as shown in Figure 22i.

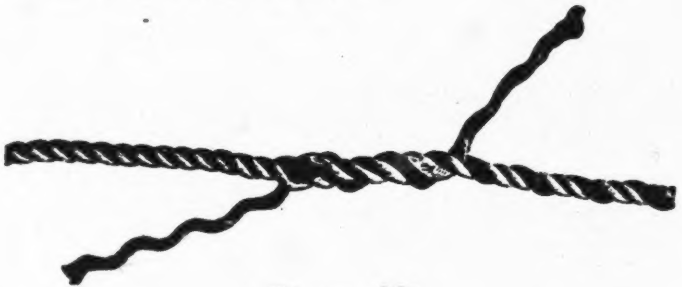


Figure 22i

When all three pairs of strands have been tucked, cut the ends off and smooth by rolling beneath the shoe or between two boards. The finished splice should appear as shown in Figure 22j.

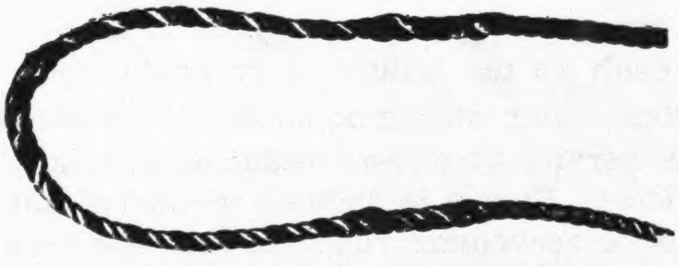


Figure 22j

THE SPLICED CROWN

Where a slight enlargement is not objectionable, the spliced crown is a desirable way to finish the end of a rope. See Figure 23. It is made as follows: Unlay six turns of the rope. Form a loop in strand A, bringing the end between strands B and C, as shown in Figure 23a. Next, move strand C between the loop in strand A and strand B, as shown in Figure 23b. Pull strand B through the loop in strand A, as indicated in Figure 23c. Draw up tight the crown thus formed, as in Figure 23d. Give each strand one tuck by bringing it over the strand nearest to it and under the second as in rope splicing. This is shown in Figure 23e. Figure 23f shows the first tuck complete. Give each strand two more tucks and cut off the ends of the strands. Smooth the crown by rolling beneath the foot on the floor. The finished crown is shown in Figure 23g.

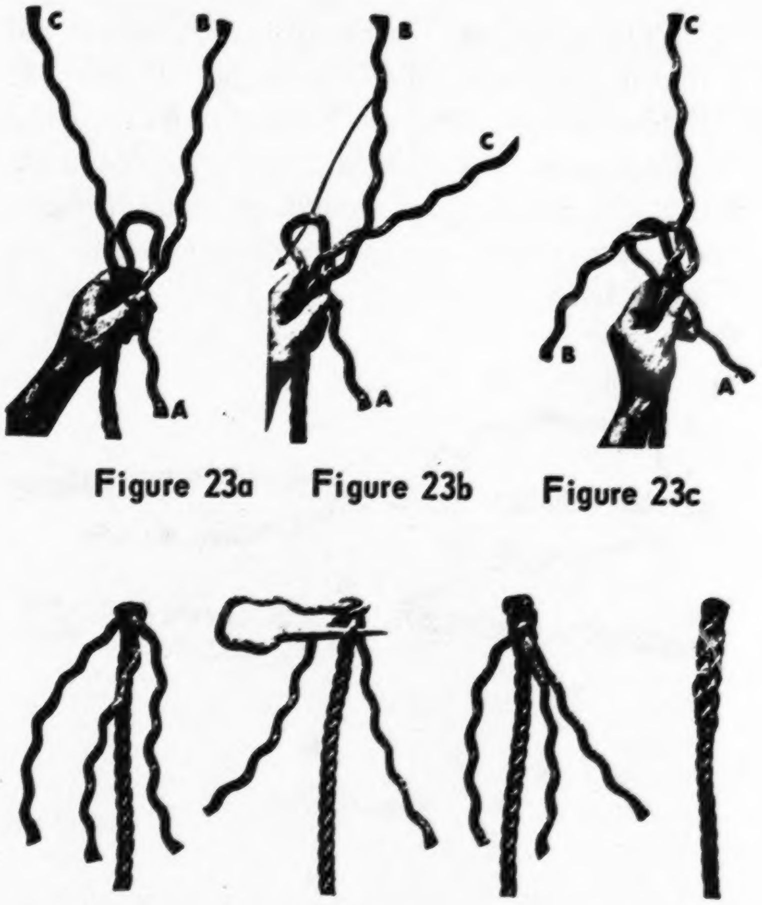


Figure 23a Figure 23b Figure 23c

Figure 23d Figure 23e Figure 23f Figure 23g

Spliced crown

ROPE COILS

In the rescue service, a knowledge of how to coil a rope correctly is essential. Many times an improperly coiled rope may result in the failure of an evolution. A rope coiler should be made and should be in service at squad headquarters at all times. Figure 24 shows a method of making a convenient rope coiler. However, any type of coiler may be used.

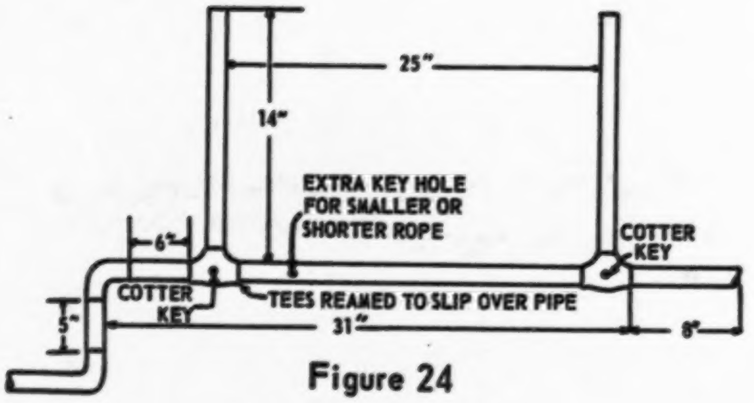

25"
14"
EXTRA KEY HOLE FOR SMALLER OR SHORTER ROPE
6"
COTTER KEY
COTTER KEY
TEES REAMED TO SLIP OVER PIPE
5"
31"
8"

Figure 24

Detail of rope coiler

In starting the coil, face the "coiler," but somewhat to the right. See Figure 25. Hold a short length of the free end of the rope inside the left coiler shaft with the heel of your left hand resting on the shaft. Take one short turn around the left shaft, then make long loops over and under both shafts.

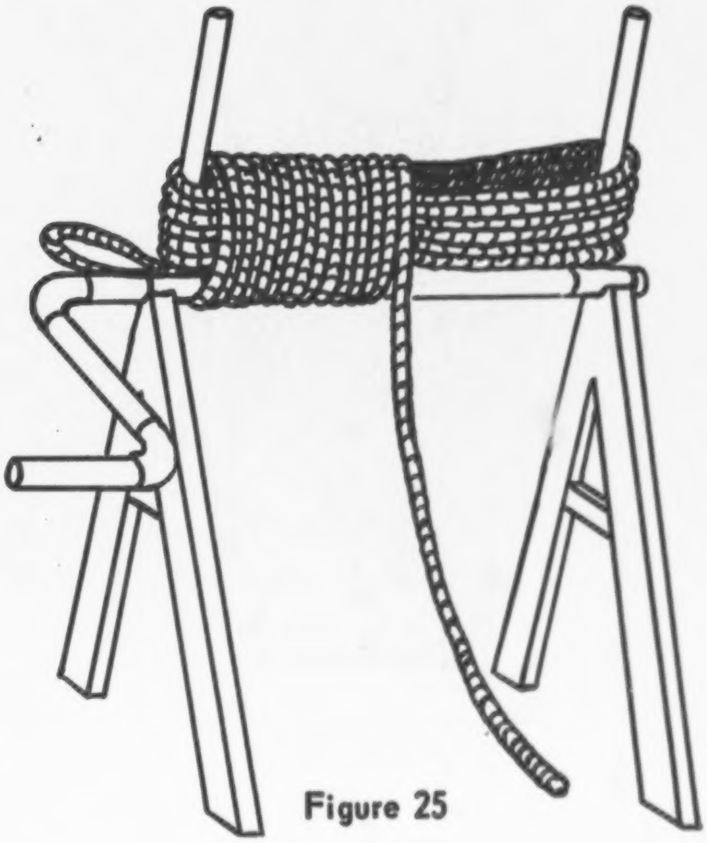


Figure 25

Rope coiler

Coil the rope around the shafts of the coiler until a sufficient amount of rope is used. See Figure 26. This amount can be determined only by trial.

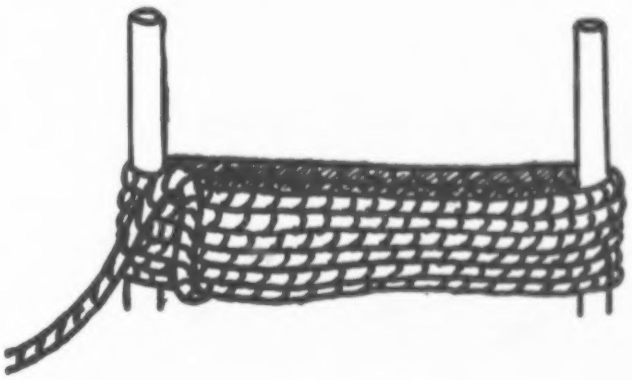


Figure 26

Begin to coil

Next, coil the rope in the opposite direction, as shown in Figure 27, by turning the coiler in the frame.

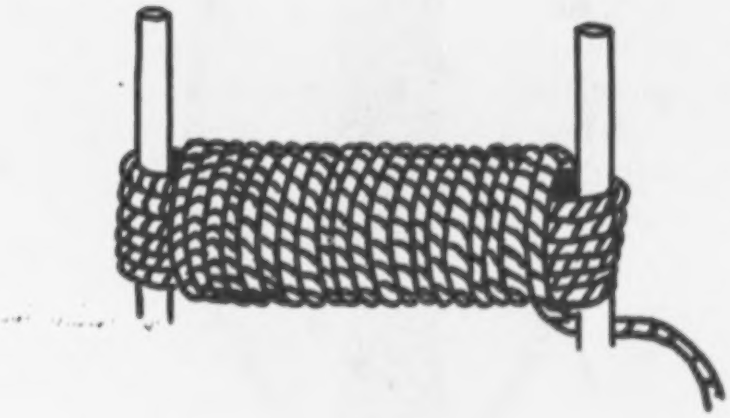


Figure 27

Coil in opposite direction

When the wrap is finished, as shown in Figure 28, remove the coiler shafts, handling the coil with care. Now double the remainder of the rope and pass the loop through the opening in the end of the coil, as shown in Figure 28, then through the opposite end of the coil.

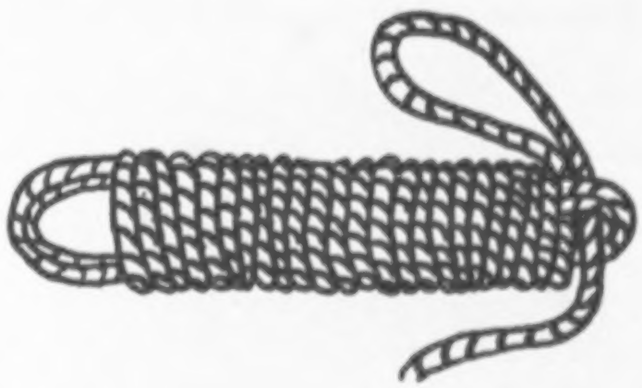


Figure 28

Finished coil

Next, insert the loose ends of the rope through the loop and pull the loop up tight. See Figure 29.

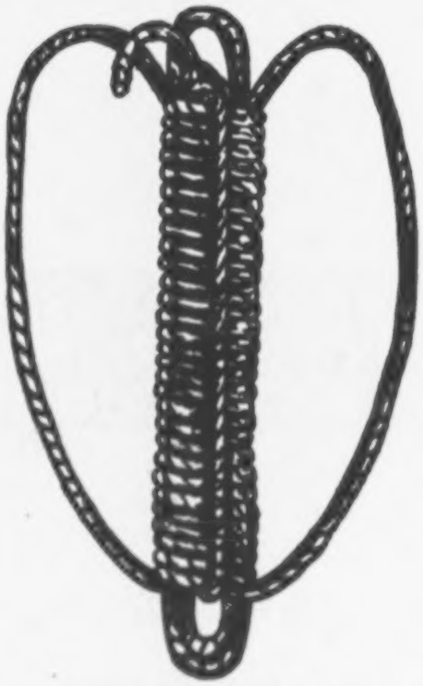


Figure 29

Coil finished and ready for carrying

If the lengths are right, the loops formed will be large enough to permit a man to load the coil on his shoulders, as shown in Figure 30. The shoulder loops may be adjusted by shortening the loose end of the rope. To undo the shoulder loops quickly, grasp the free end near the center of the coil and pull away from the coil, thus unlocking the end, and continue pulling until the shoulder loops come clear of the coil. This long end is dropped with the coil.

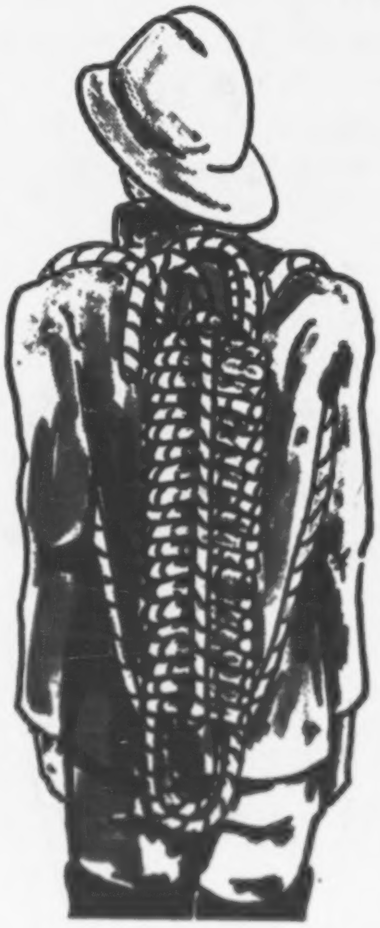


Figure 30

Carrying coil

When dropping the coil from a height, grasp the inside free end and pull several feet out from the core. Retain this aloft. When pulling out on the ground, also pull out the core first.

COIL FOR THROWING ROPE

At times it becomes necessary to throw a rope from a roof, upper story, or over an object. There are several ways in which rope can be coiled for throwing. A good method is as follows: Coil several loops not over 18 to 20 inches long, like A in Figure 31. Carry the next loop through the slack and up to make loop B. Then hold loop B in the right hand with loop A hanging in loop B at D. Next, coil a series of small loops about 12 inches in diameter on top of loop B in the right hand. The rope is now ready to throw. Practice is necessary to throw accurately and to determine the amount of coiled rope necessary for the distance to be covered. Rope will straighten out completely on the throw.

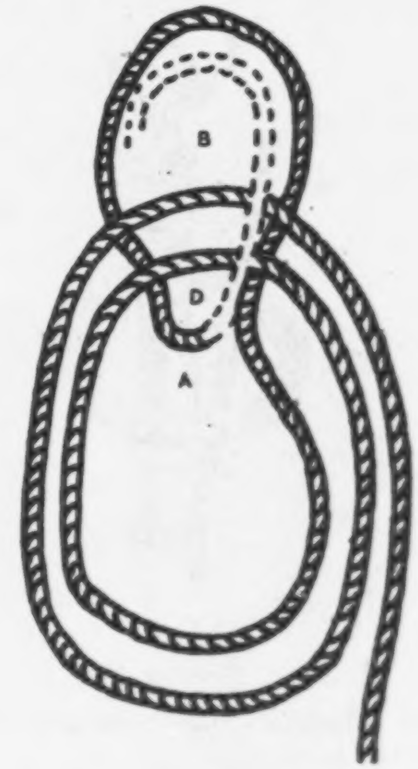


Figure 31

Coil for throwing rope

SUPPLEMENTARY ILLUSTRATIONS OF KNOTS AND HITCHES

In the preceding section, detailed instructions were given on tying the various knots and hitches used in rescue service. Very little information was given, however, as to their actual use. Figures 32 to 38 illustrate actual usage of several of the knots and hitches as well as additional ways of making some of them.

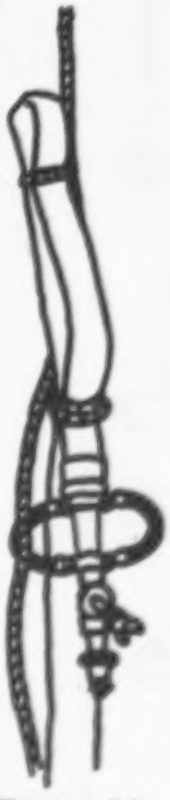


Figure 32

Hoisting uncharged line with running bowline

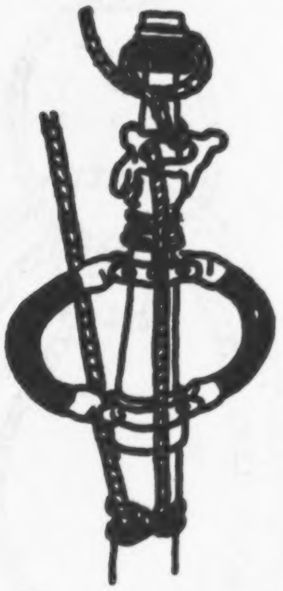


Figure 33
Hoisting charged line with clove hitch & half hitch - Method 1

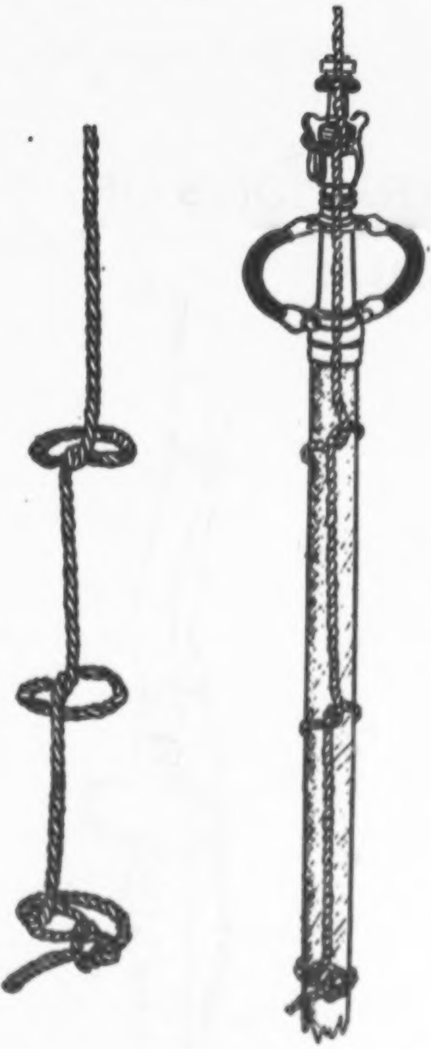


Figure 34
Hoisting charged line with bowline and half hitches - Method 2

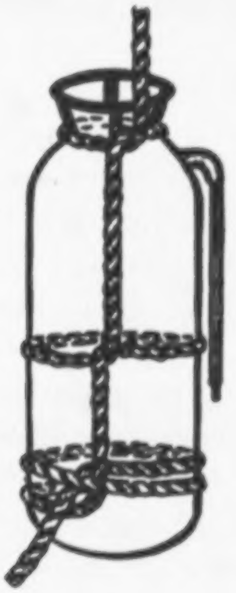


Figure 35
Hoisting extinguisher

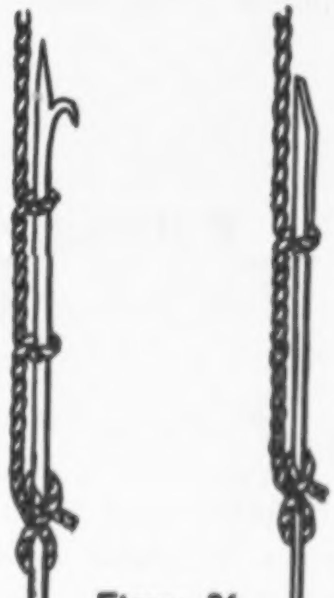


Figure 36
Hoisting pike and bar

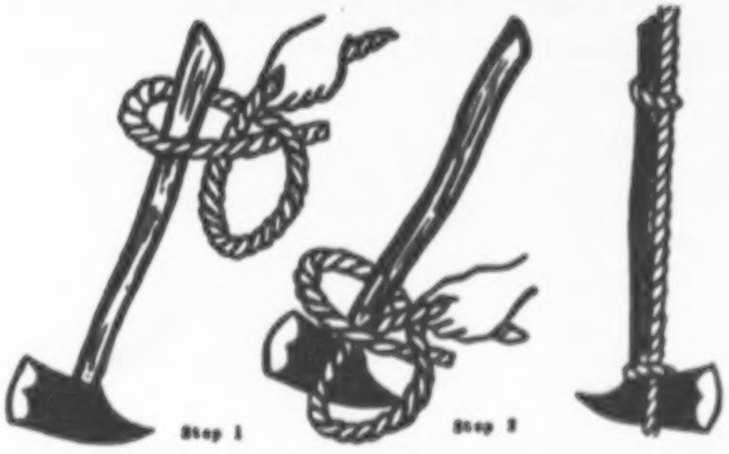


Figure 37
Hoisting axe

The tackle knot shown in Figure 38 is a hitch used for pulling operations when blocks are not available, or for stretching a tight line. If used for the latter purpose, the pull rope should be taken back and tied around both parts A and B using the chimney hitch.

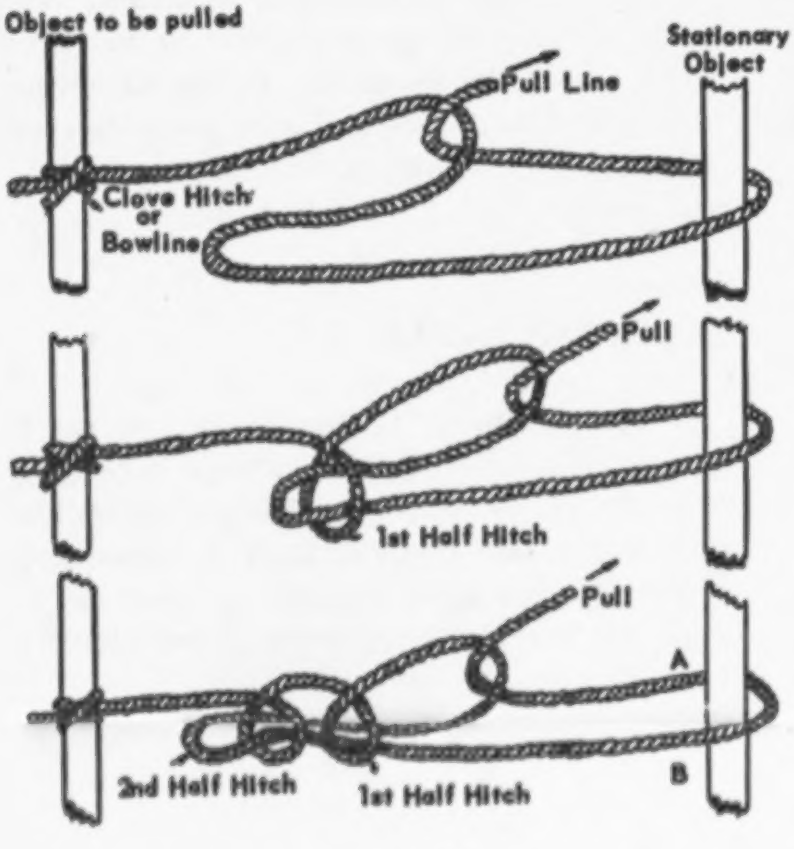

Object to be pulled
Stationary Object
Pull Line
Clove Hitch or Bowline
Pull
1st Half Hitch
Pull
A
B
2nd Half Hitch
1st Half Hitch

Figure 38
Tackle knot

For hoisting ladders with a bowline, follow the procedure in Figure 39. The tie is made at about one-third of the length of the ladder from the top end. Start rope around beam and out the front side and continue with rope around opposite beam, bringing it out behind the cross rope.

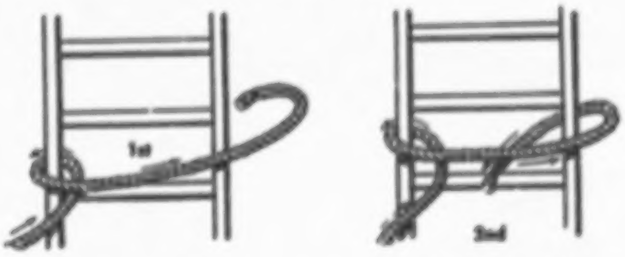


Figure 39a Figure 39b
First steps in hoisting ladder using bowline

Next, a bowline is made with the hand next to the ladder while facing the top.

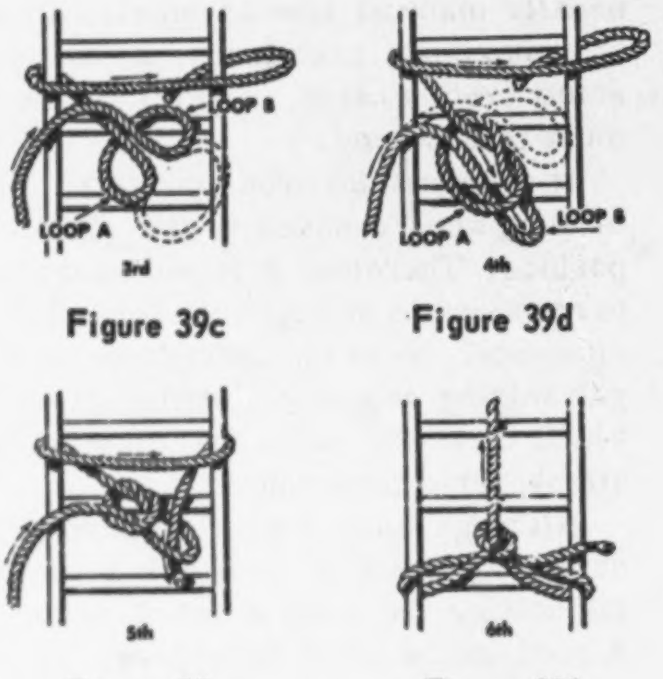

LOOP B
LOOP A
3rd
LOOP A
LOOP B
4th
5th
6th

Figure 39c Figure 39d

Figure 39e Figure 39f
Completing hoisting ladder using bowline

Pull the knot taut. It will lie just above the cross rope. When using this hoist, turn the ladder over so the knot is between the ladder and the building. When hoisting roof ladders the tie should be made on the third rung above center.

CABLE

Cable, sometimes called "wire rope", is usually made of iron or steel. To obtain the maximum usefulness, economy, and safety from a cable, several simple rules must be observed.

It is normal for iron or steel to corrode or rust when exposed to the air for long periods. Therefore it is necessary to take precautions to protect iron cable from the elements. Some manufacturers do this by galvanizing and other coating processes, which make the cable less susceptible to atmospheric conditions.

Although lubrication is applied to cable during fabrication, it is not sufficient to last during the cable's entire useful life. A good grade of oil or grease, free from acids and alkalies, should be applied periodically.

A wire cable is a machine of many moving parts. Each time the cable bends or straightens, the wires in the cable slide on each other. The lubricant must be able to penetrate between these strands. A rusty cable is a liability; therefore cables should be kept clean and free of rust by the use of scrapers and wire brushes.

Contact with chemicals, alkalies, and acids which destroy the metal or internal core, should be avoided. Cable should be stored in a dry place and must be inspected periodically for breaks, damage, weakness, and wear.

BLOCK AND TACKLE

This equipment is used in rescue work to provide a mechanical advantage in raising or moving heavy objects. A block and tackle consists of two blocks, usually connected together by as many strands, or reeves, of rope as there are sheaves in the blocks. (See Figures 40 and 41 .)

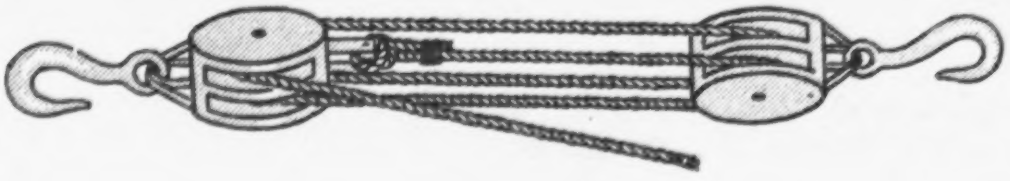


Figure 40

Block and tackle with double-to-double reeving

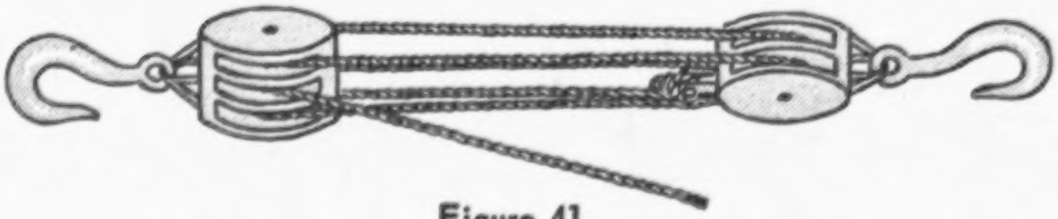


Figure 41

Block and tackle with triple-to-double reeving

The number of strands of rope which support the weight or load determine the mechanical advantage ratio. For example, to raise a 500-pound load, the effort required on the pull line of a three-and-two combination tackle (excluding friction) is 100 pounds.

An ordinary or straight block and its component parts are shown in Figure 42.

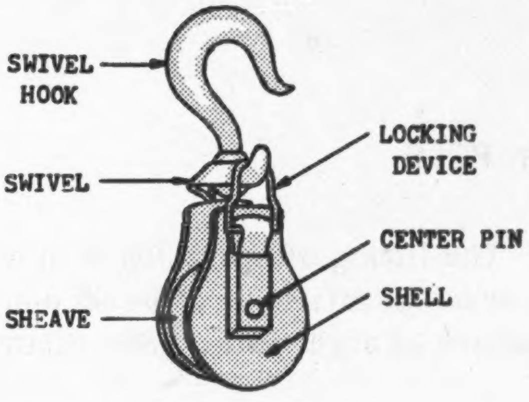

SWIVEL HOOK
SWIVEL
SHEAVE
LOCKING DEVICE
CENTER PIN
SHELL

Figure 43
Snatch block

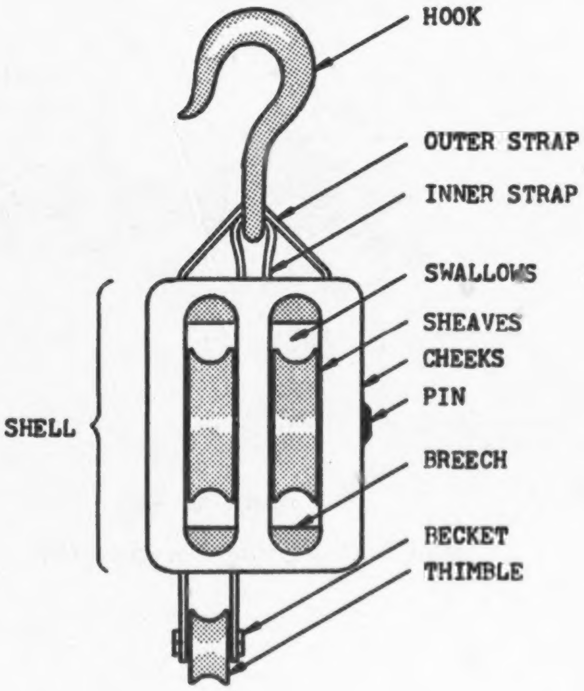

HOOK
OUTER STRAP
INNER STRAP
SWALLOWS
SHEAVES
CHEEKS
PIN
SHELL
BREECH
BECKET
THIMBLE

Figure 42
Straight block

Figure 43 shows a snatch block, generally used in rigging operations to achieve a change of direction in pulling. It consists of a single block with an opening and locking device on one side to permit the rope to be inserted.

Often additional precautions must be taken to prevent a rope or sling from slipping or jumping out of a hook. Precautions are needed when a person is being raised or lowered, when his weight might surge during an operation, or while he is being supported temporarily before beginning the operation. This safety practice is called "mousing" a hook. A piece of cord or heavy twine is wrapped around the opening in the hook and is secured by a square knot. (See Figure 44.)

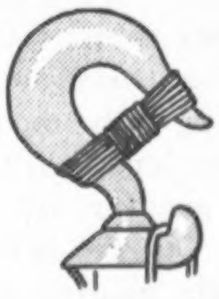


Figure 44
Moused hook

POLES

GIN POLE

The lifting of heavy loads or victims in rescue operations is often accomplished by the use of a gin pole. (See Figure 45.)

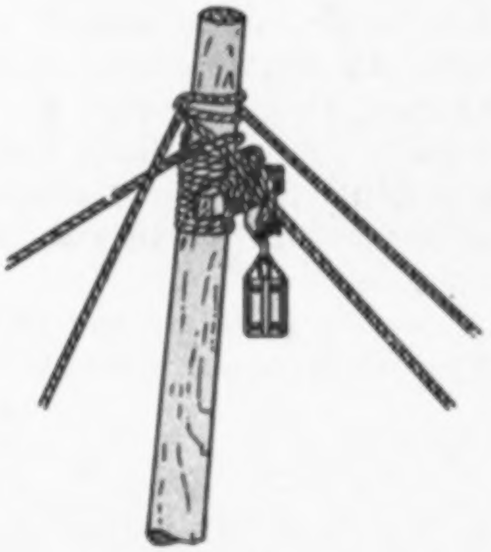


Figure 46

Square lashing top of gin pole

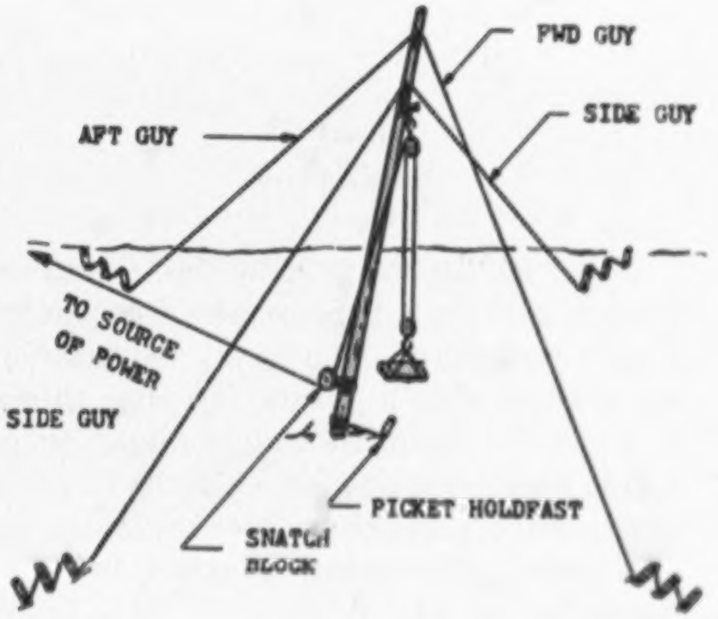

FWD GUY
AFT GUY
SIDE GUY
TO SOURCE OF POWER
SIDE GUY
PICKET HOLDFAST
SNATCH BLOCK

Figure 45

Gin pole

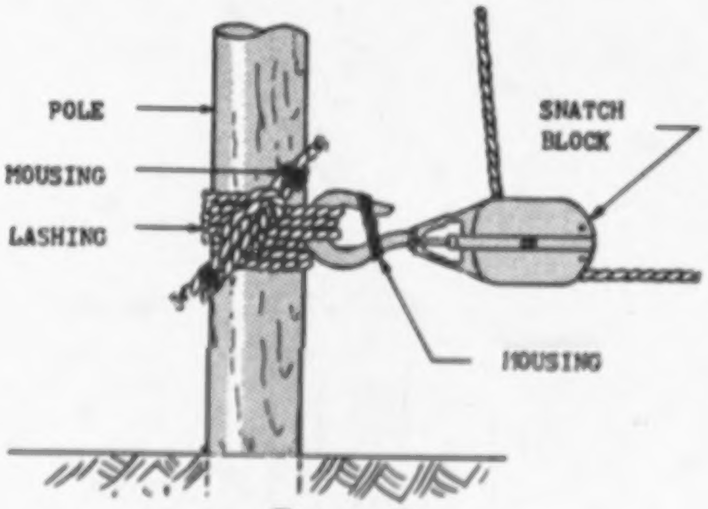

POLE
MOUSING
LASHING
SNATCH BLOCK
MOUSING

Figure 47

Round lashing base of gin pole

A gin pole usually consists of a single pole held in a nearly upright position by four guy lines. The tackle is attached to the single pole. The pole may be made from any timber, which must be chamfered at the top or designed in some other manner for the attaching of the tackle. In general, the shorter the length of the pole bearing the load, the greater will be its capacity.

A block and tackle is lashed to the top of the pole. The hauling part of the tackle leads through a snatch block at the base of the pole to the source of power. Details of typical lashings are shown in Figures 46 through 48.

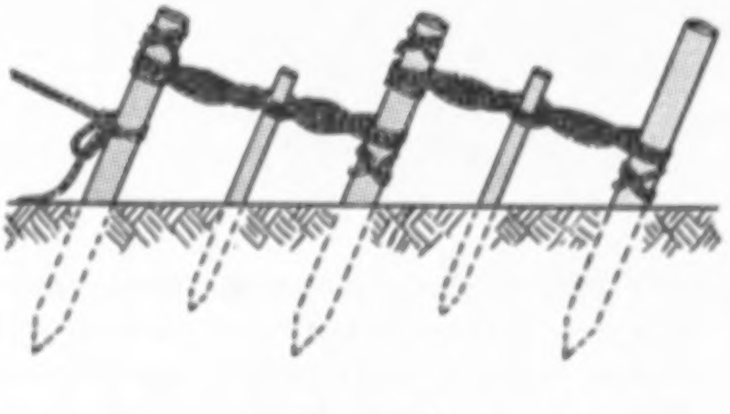


Figure 48

Pickets or holdfasts

LADDER GIN POLE

When suitable poles and timbers are not available, ladders may be used to rig gin poles and sheerlegs.

Figure 49 shows a ladder gin pole. It can be set up as follows:

1. Attach a rope or sling around the rails near the top of the ladder to support a block and tackle.
2. Fasten two guy lines to the ladder, one on each rail where the sling is secured.
3. Raise the ladder to the desired position, and anchor the guy lines. (See Figure 49.) If necessary, anchor the ladder at the bottom to keep it from slipping.

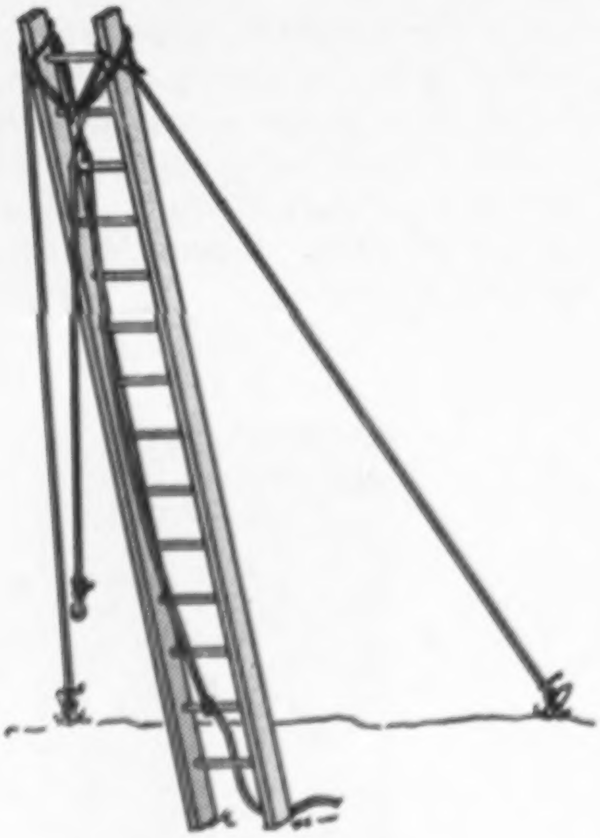


Figure 49

Ladder gin pole

LADDER SHEERLEGS

To erect sheerlegs with ladders, as shown in Figure 50:

1. Place one ladder on top of another and lash the beams together loosely at the top.
2. Turn the ladders on their beams and spread the unlashed ends to form a "V".
3. At the lashings, attach a sling to support the block and tackle, and fasten guy lines at the lashing around the beams on each side.
4. Raise the ladders and anchor the guy lines. Anchor the ladders at the bottom to prevent spreading.

Sheerlegs constructed with ladders cannot be drifted and, like tripods, they are restricted to vertical lifting.

In both of these operations, if speed is of importance, the lines need not be staked out as shown. Men could be assigned to hold the guy lines.

A stepladder can be easily and quickly assembled by tying two straight ladders together, as shown in Figure 51. A tie line must be used at the bottom to keep the ladders from spreading. The rope should be attached to the bottom rungs of each ladder and fastened securely with clove hitches at each end.

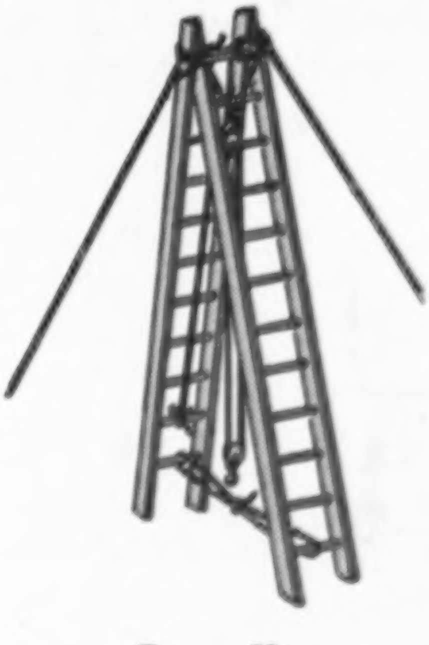


Figure 50

Ladder sheerlegs

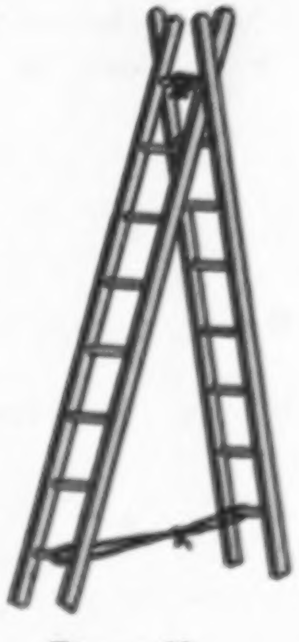


Figure 51

Assembling stepladder

VICTIM RESCUE

BODY TIE AND HARNESS

A good method for securing a victim, when he is to be either raised or lowered, during rescue, is the "Approved Body Tie". (See Figure 52.)

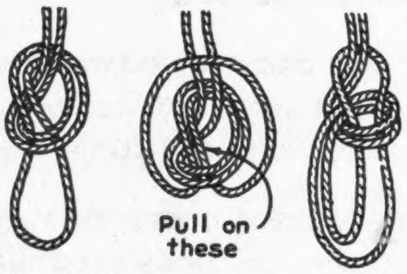

Pull on these

Figure 52a

Bowline on a bight adapted for body tie

This tie is an adaptation of the bowline on the bight. In tying it, about three feet of free end must be left outside the knot. Either loop of the bowline is slipped over each leg of the victim to be rescued. Take care to draw these loops as far up to the crotch as possible. Then, throw a half-hitch under the arms. Throw a bight in the standing line in front of the chest. Then pass the loose end of the rope through the bight. The line is then drawn tight, making a firm knot.

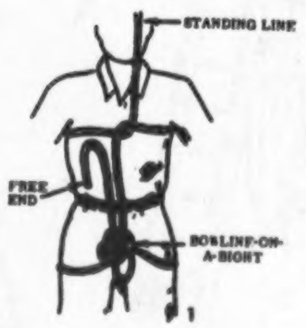

STANDING LINE
FREE END
BOWLINE-ON-A-BIGHT
1

Figure 52b

Start of body tie

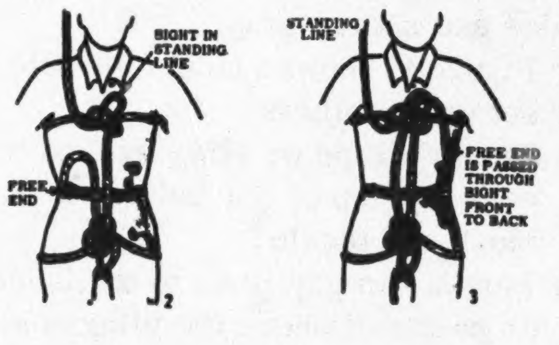
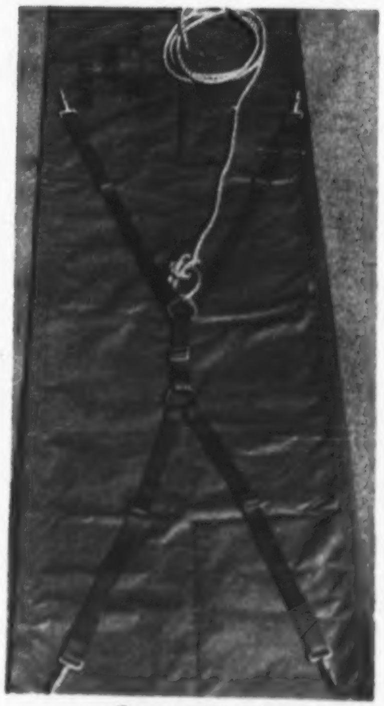

BIGHT IN STANDING LINE
FREE END
2
STANDING LINE
FREE END IS PASSED THROUGH BIGHT FRONT TO BACK
3

Figure 52c Figure 52d

Body tie complete

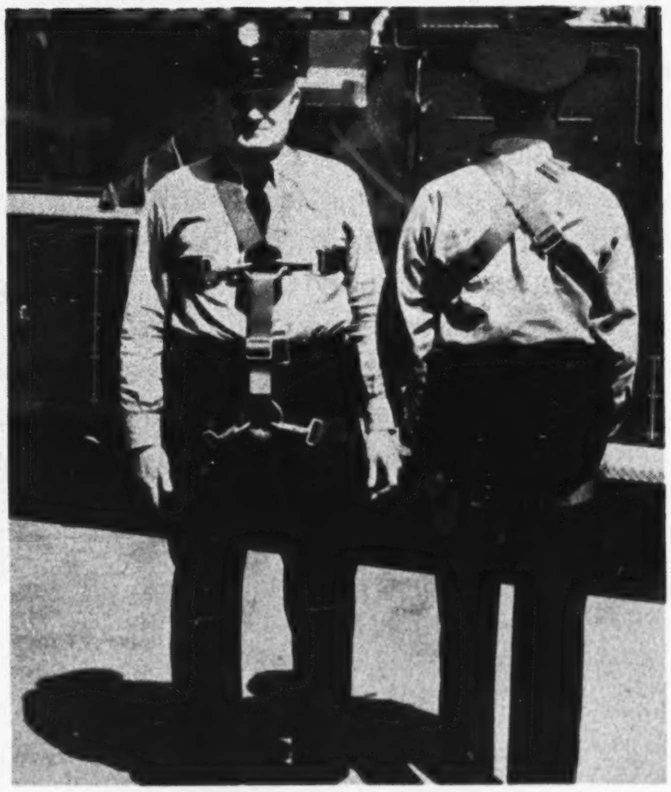
Another method for raising or lowering victims is by the use of a body harness. The harness has the advantage of being easier and less time-consuming to place on the victim. Figure 53 shows a sketch of one type of harness. Figure 54 shows the harness in place.



Courtesy Lynhurst F.D.

Figure 53

Body harness



Courtesy Lynhurst F.D.

Figure 54

Body harness in place

SUSPENDING VICTIM HORIZONTALLY ON STRETCHER

A victim on a stretcher may be raised or lowered while in a horizontal position, using either a one-point suspension method or a four-point suspension method. The first method is especially useful when lowering or hoisting victims several floors, and when using lifting devices such as derricks and gin poles. (Fire department aerial ladders can sometimes be used for this purpose. A separate section on aerial ladder rescue can be found in this manual.) The four-point method is more useful for shorter distances.

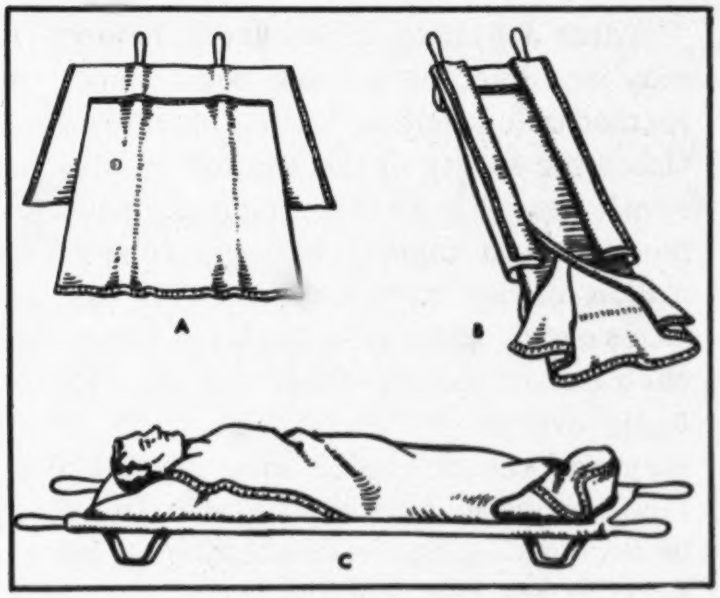


Figure 55

Method of wrapping victim

In preparing to lower a victim horizontally, first wrap him in a blanket or salvage cover. (See Figure 55.) Lash him securely to the stretcher, starting with a clove hitch on one of the handles near the head. Then pass the rope partway down one side of the stretcher, taking a complete turn underneath and back over the victim's chest, and making a half-hitch at the side. Extend the rope on down the side of the stretcher, making at least two more turns, one just above the knees and one just at the wrists with hands at side. Then pass the rope around the victim's feet, bring it up on the opposite side of the stretcher, and secure it with a clove hitch. (See Figure 56.)

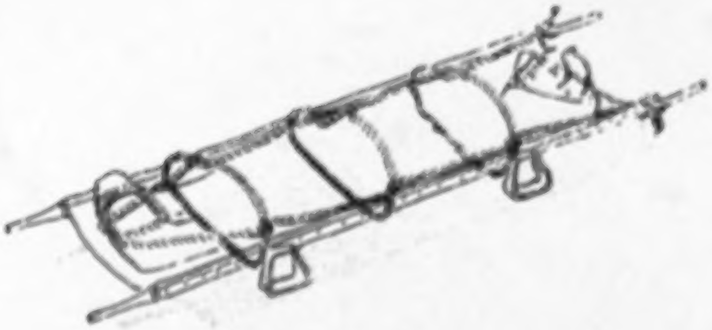


Figure 56

Victim tied on stretcher

After a victim is securely lashed, he may be moved by the one-point suspension method using another rope. Measure three times the length of the stretcher, plus one arm's length. Double the rope and tie a bowline on a bight. Lay the rope on the middle of the stretcher and draw the two loops even. Then pass the large loops over each end of the stretcher and put smaller loops over each handle. Secured in this manner, the stretcher may be raised or lowered without tilting. Guide lines may be attached to the stretcher when necessary. (See Figure 57.)

To use the four-point suspension method, first lash the victim as previously explained. Instead of using the bowline on a bight, fasten a lashing line to each handle of the stretcher with a half-hitch and secure the line to the "D's" with a bowline. Four men are needed in hoisting or lowering, one man to control each line. Men should wear gloves to prevent the ropes slipping or burning their hands. Where a stretcher is to be hoisted or lowered only a short distance, forty-foot lashing lines may be used. (See Figure 58.)

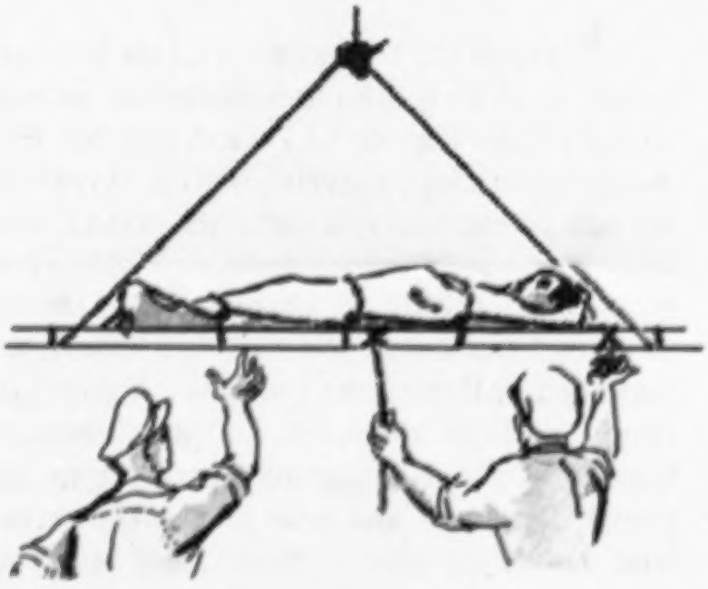


Figure 57

One-point suspension method

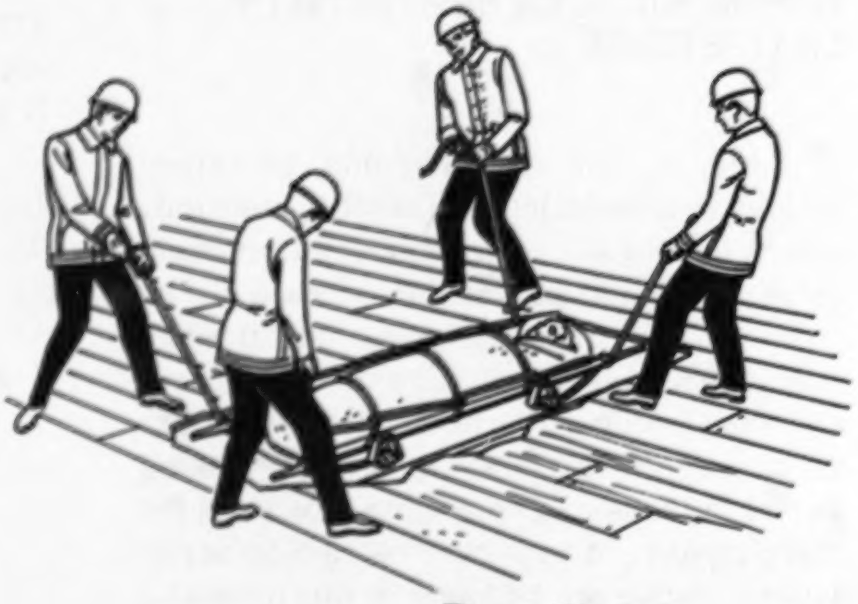


Figure 58

Four-point suspension method

If a ladder is substituted for a stretcher, either the one-point or four-point suspension method may be used. In either case, the victim must be lashed securely, as shown in Figure 59.

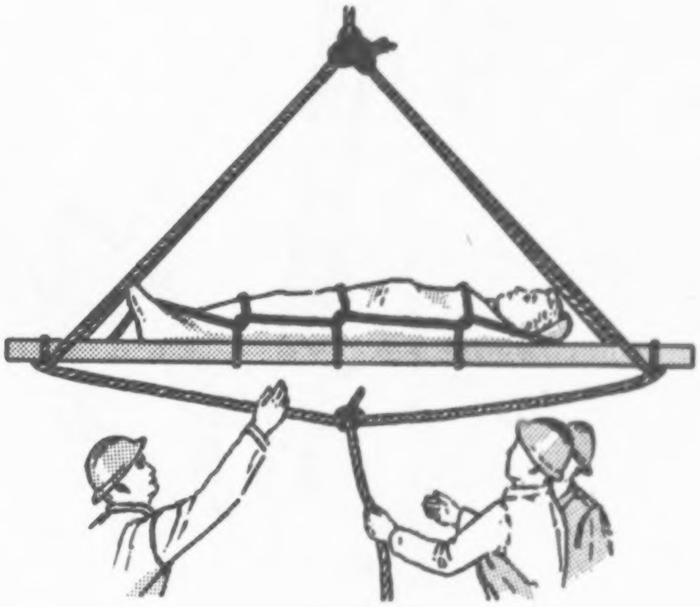


Figure 59

Secure lashing of victim

SUSPENDING VICTIM VERTICALLY

Frequently victims must be lowered feet first because the only available opening is narrow. Several methods may be used to raise and lower victims in a vertical position. The backboard is best for this type of rescue, since the victim can be secured in it and a lowering rope fastened to the head end. When lowering a backboard, attach a guide rope to the lower end sufficient in length to reach the ground.

To lower a victim vertically, first lash him to a backboard as described in Chapter XIII. Secure the lowering line to the hand holds at the head of the backboard by tying a bowline. Attach a guideline to the hand holes at the foot of the backboard.

Figure 60 illustrates the use of a ladder in place of a backboard for lowering a victim vertically.

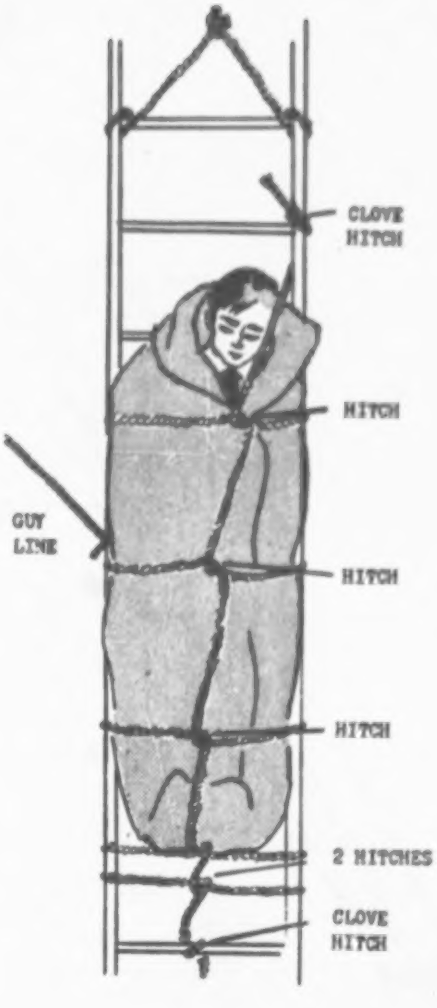


Figure 60

Use of a ladder

Figure 61 shows how a ladder can be used in connection with the vertical method of lowering a victim on an army stretcher. Two poles are run through the "D's" to serve as skids on the ladder beams. Stakes should be driven into the ground at the base of the ladder, and the beams should be lashed to these stakes.

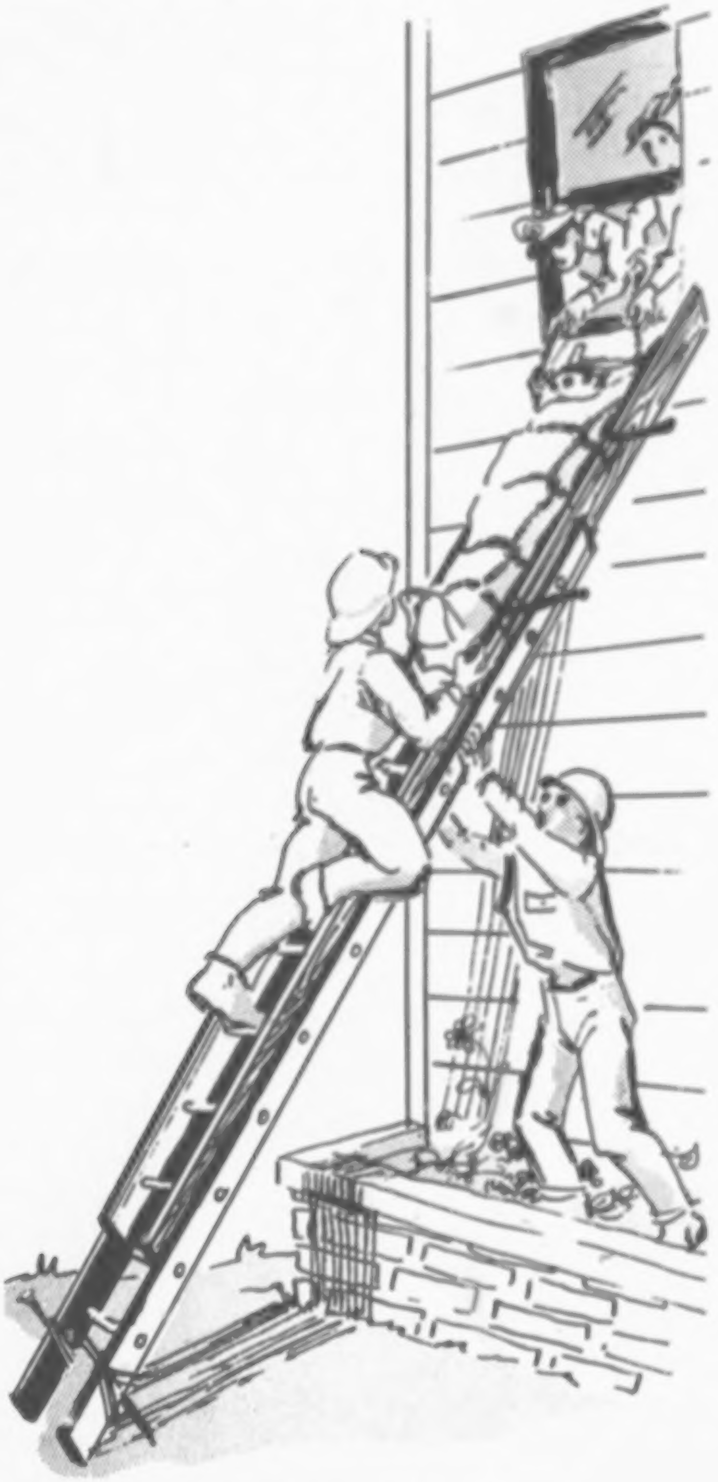


Figure 61

Using a ladder in connection with lowering a victim vertically

MAKING A WIRE RESCUE

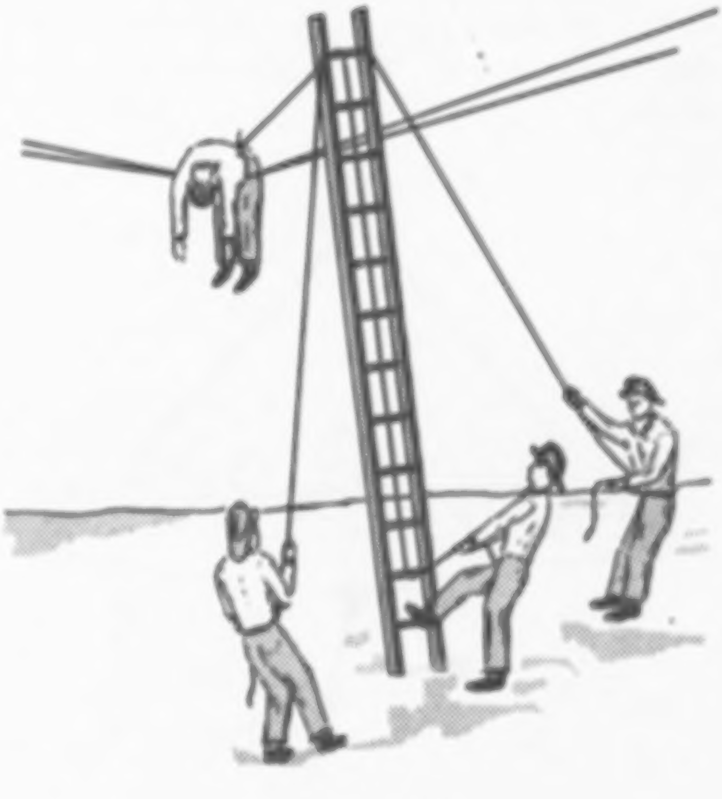


Figure 62

Making a wire rescue

To take an unconscious man off overhead wires, as shown in Figure 62, use a ladder that extends at least five feet above the victim. The ladder is placed climbing side down, with the heels some distance out from the spot directly below the victim. One man doubles a long rope and places the middle of it across the top of the ladder, then tucks it under the top rung, pulls through some slack, and makes a partial cat's paw over each top end of the ladder beams. Trailing ends of the rope then come off outside of the beams. The rope should be spread to make an angle of about ninety degrees, and the ladder top should be laid in toward the victim. Two squadmen heel the ladder. A third man passes another rope beneath a low rung, pulls it back through at the second rung above, ties a running bowline in the end, and throws this over his shoulder. He climbs above the victim, leg-locks in, passes the rope over a high rung, then drops a lasso loop over the victim. The rescuer then rapidly descends. While he is coming down, the ladder is laid in as closely as possible to the victim. The rescuer pulls the slack out of the rescue rope and snubs it on a low rung. The other rope men slowly pull back on the top of the ladder until the victim is pulled clear of the wires. Care should always be taken so that the ladder does not go past the vertical position.

A metal ladder should not be used for this operation because of the danger of touching the conductor or the possible arcing from a live line.

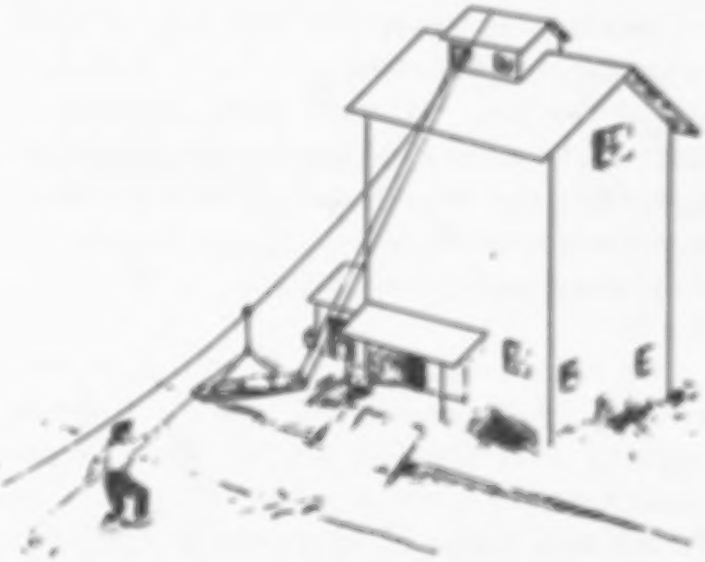


Figure 63

Lowering victim from high places

LOWERING VICTIM FROM A HEIGHT

Emergencies sometimes occur which make it necessary to lower victims from high places. Figure 63 shows one satisfactory method for doing this which is used particularly when the base of the structure is not suitable for lowering the victim vertically. In this method, a sheave block is used on a rope or wire cable sloping from a high part of a building and anchored at or near the ground. A backboard, with the victim, is suspended from the running pulley. A backboard with footrest is the most desirable type for this operation because it facilitates the lashing of the victim securely. Two guide lines are attached at the lower hand holes at the ends of the backboard during its descent. This technique is sometimes referred to as a "breeches buoy" or "Telfar line".

ACTUAL RESCUE OPERATION

The following is an account of an actual rescue operation as reported by the Chief of the Sylvania Fire Department, Sylvania, Ohio.

On September 7, 1956, the Sylvania Township Fire Department received a call from an elevator company. When we arrived we were told that three men were in a grain pit. The elevator was approximately seventy-five feet high, and the trapped men were about forty feet below the top of the elevator which was also the level of the grain. We had to use a vertical belt conveyor to arrive at the floor. A long five-eighths-inch rope, self-contained masks, and three resuscitators were taken immediately to the floor. A squadman was lowered into the pit by use of a body tie. Since it was suspected, and later verified by test, that there was not enough oxygen to support life in the pit, the squadman wore a self-contained mask.

Another line was used with a body tie to raise the men out of the pit. As we got them out of the pit, we used resuscitators on them. The first two men responded satisfactorily, and were fastened to the belt conveyor and lowered to the ground floor where they were taken to a hospital.

We were unable to bring the third man around. A physician had arrived and was working with firemen on the third victim while the others were being lowered. The victim was strapped on an army stretcher with two-inch-wide webbing. The physician in the meantime, cut an opening into the victim's windpipe to induce breathing. A one-tank resuscitator was strapped on him.

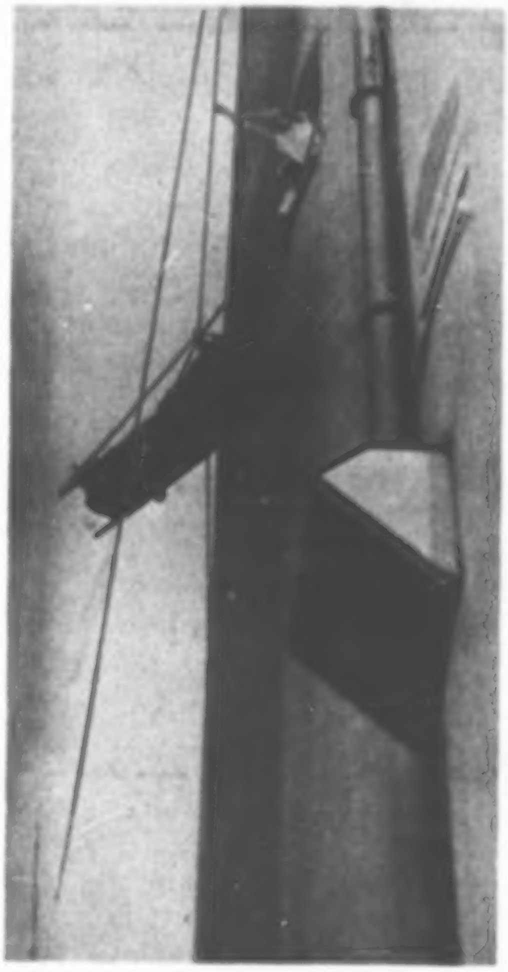


Figure 64

Victim being lowered from grain elevator

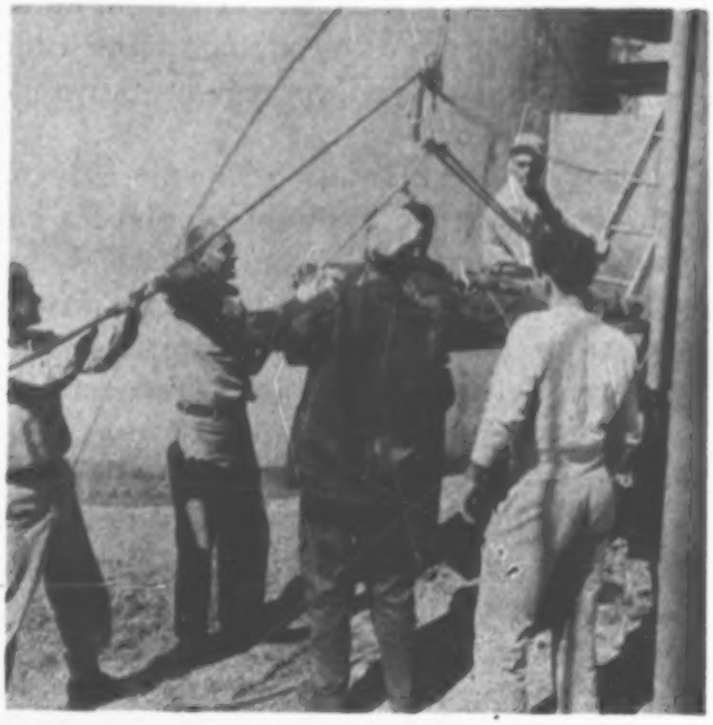


Figure 65

Victim lowered to ground level with improvised rig

To lower him by use of the belt conveyor would mean having to lower him in a vertical position. Therefore, we placed a snatch block to the side, and above a window a three-eighths-inch steel cable about two hundred feet long was placed in the block. A stretcher tie was used on the stretcher and this was attached to the cable. Using one-half-inch and five-eighths-inch, one-hundred-foot lengths of rope as guide lines, the victim was lowered to the ground from this elevator. (See Figures 64 and 65.)

The victim was placed in the ambulance, accompanied by the physician, and taken to the hospital. He was pronounced dead-on-arrival. The other two survived.

CHAPTER XXI

SHORING AND TUNNELING

INTRODUCTION

In emergency rescue operations it sometimes is necessary to support a damaged structure or a cave-in, or to provide bracing for walls and ceilings. A squad may have to construct tunnels to rescue trapped victims. The shoring or tunneling must be done rapidly, but safety must not be sacrificed for speed.

Only the amount of shoring or tunneling required for the safe removal of victims and workers should be carried out by a rescue squad. No attempt should be made to restore any structure to its original position; restoration should be left to the guidance of skilled craftsmen.

SIZING UP AN EMERGENCY

At a cave-in the squadman may be confronted with two types of rescue problems:

(1) The head of the victim is not covered.

(2) The victim is completely covered by some type of material. In either case care must be taken to protect the victim from added injury. Size up the situation and plan your approach before action is taken.

When a victim is partially buried with his head exposed, start administering oxygen. Use the inhalator if he is breathing. Use the resuscitator if he is not breathing.

If a victim is completely buried (e.g. under loose gravel), the man in charge of rescue must, if able, find the approximate location of his head and chest. A squadman should be prepared to begin administering oxygen as soon as the victim's head is exposed.

APPROACHING A VICTIM

When you approach a cave-in victim on foot, be sure to distribute your weight over the largest area possible. Do not increase the amount of weight that is already present on the victim's chest cage. It may be necessary to crawl on your hands and knees or stand with your legs wide apart. Long-handled shovels are of great assistance in this situation, since the material covering the victim can be removed and at the same time the squadman can stand at a distance away from the victim. All squads should be equipped with long-handled shovels.

Many times, a squadman will be required to lie flat on his stomach and reach the victim with just his hands. The squadman should approach the victim from behind to administer oxygen, if possible, so that other personnel can relieve pressure from the victim's chest.

SHORING

When a victim is under loose debris it may be necessary to clear a path slowly and carefully to him, shoring with the progress of the path, as is done in mining operations.

Shoring is also necessary sometimes after traffic and railroad accidents. Heavy weights must sometimes be supported while cutting through metal wreckage; or the wreckage must be raised by means of jacks, and then supported, so that progressive access can be made to where the victim is pinned or trapped.

To brace a wall that is bulging or in danger of collapse, a raked shore can be built. (See Figure 1.) Raked shoring is usually built up from ground level.

A flying shore can be used to brace one wall from another support across a space. (See Figure 2).

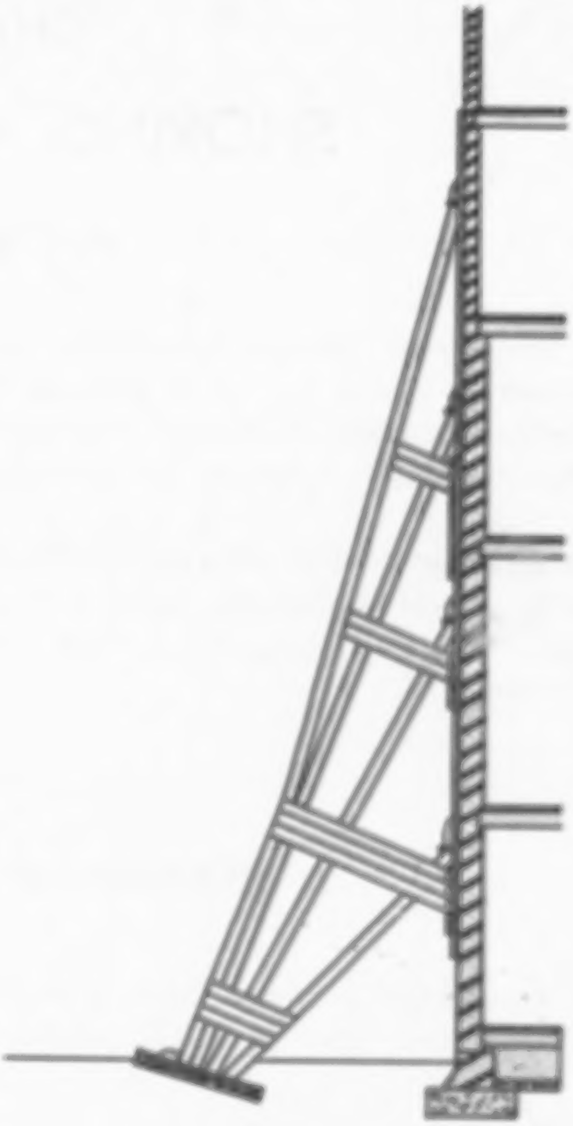


Figure 1

Raked shore

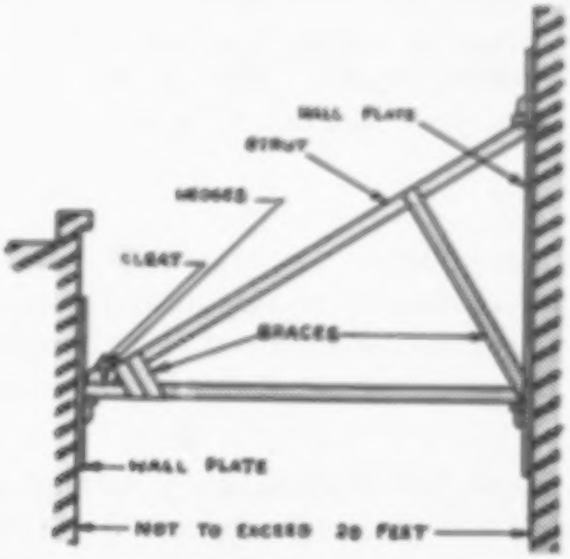


Figure 2

Flying shore

BULKHEADS AND COFFERDAMS

In cave-in accidents involving ditches or wells, and in other similar accidents, it is sometimes necessary to sink bulkheads or cofferdams for shoring.

TUNNELING

Tunneling becomes necessary when the rescue workers must remove victims trapped either near the surface or in voids underneath collapsed structures or ditches, or under sand, gravel, coal, grain, etc. (See Figures 3 and 4.) In these rescue operations, tunneling requires exceptional skill and should be guided by trained personnel.

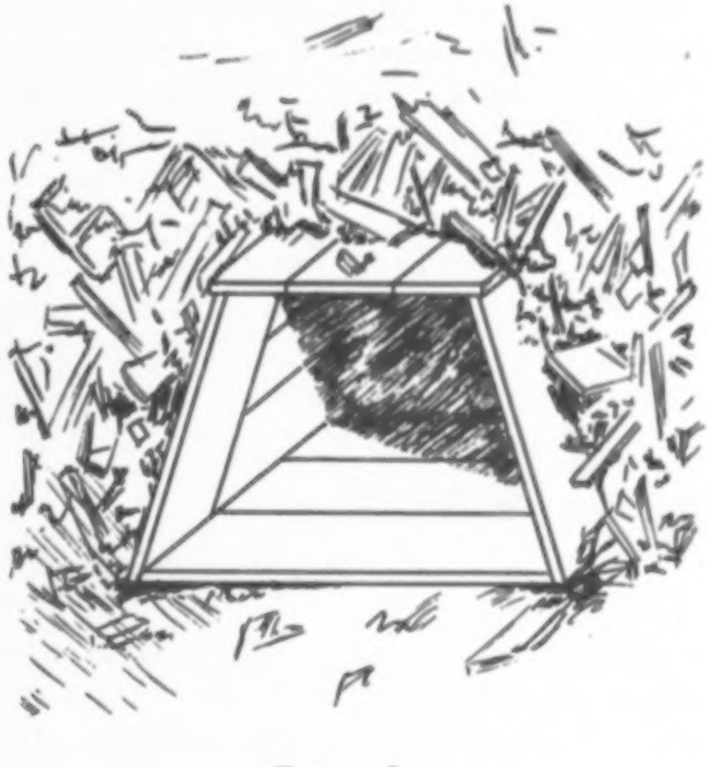


Figure 3

Tunneling through debris

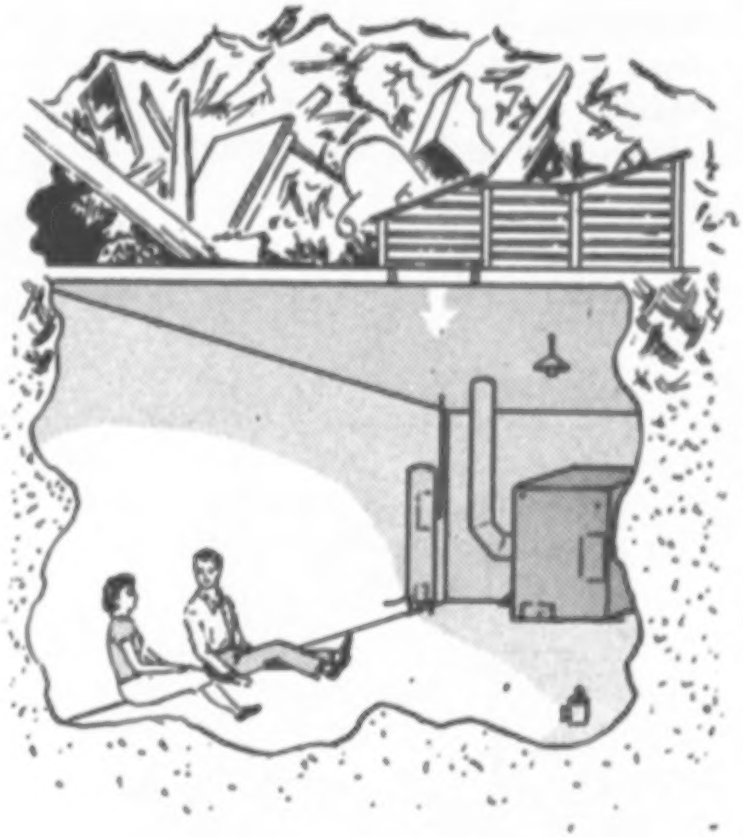


Figure 4

Rescue from a basement where ceiling remains almost intact

TECHNIQUES AND TOOLS

Shoring and tunneling are best accomplished with the use of timbers and wedges. The construction work sometimes has to be done gently and without jarring, to prevent further collapse. Figure 5 shows a damaged wall supported by a shoring of heavy timber.

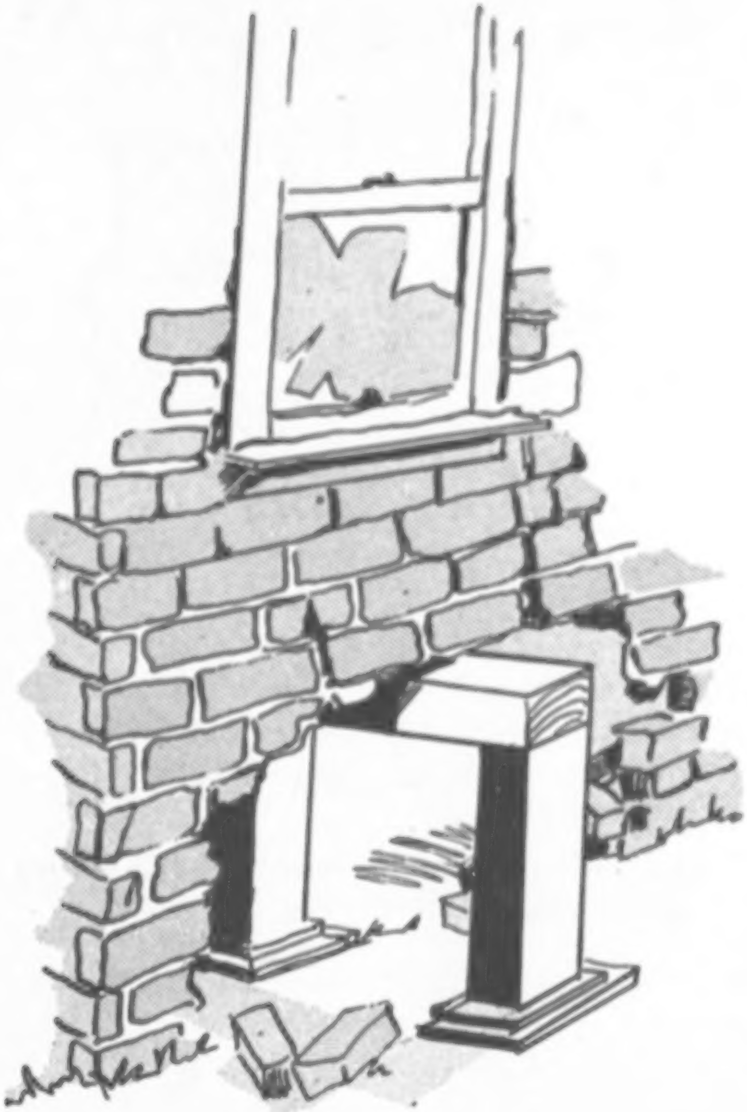


Figure 5

Use of heavy timber for shoring

Cut the supporting timbers short, then make them fit snug with wedges. Unnecessary jarring can be avoided, yet a snug fit can be accomplished when this method is used.

Shoring and tunneling should, of course, be safe and secure, to protect both the victim and rescuers. It is often necessary for rescue teams to work in relays. This may require several trips in and out.

Minor accidents may involve only the use of rope, shovels, pails and carpentry tools needed for shoring. Accidents of major proportions and those involving large buildings may demand the use of bulldozers, power shovels, drag-lines, trucks, and other heavy-duty equipment, with skilled operators. At the scene of a rescue if the squad leader finds conditions that require the use of heavy equipment, he should not hesitate to request the services of such equipment. In many communities this means putting into effect a pre-arranged plan to meet such situations, prepared long before the emergency arises.

DANGER OF FURTHER INJURY

When a victim is buried, extreme care must be exercised in the use of power equipment. The rescue activities could injure the victim further, or kill him. Speed is important for many reasons, but not important enough for over-zealous digging. Squadmen and operators should be constantly alert to observe any part of the victim's body as it is revealed. When observation reveals the body of a victim, the rescue operation should proceed cautiously and carefully with a minimum use of power tools.

AVOIDING CAVE-INS

When raising victims from cave-ins, ditches, or voids, it is important to prevent the edges from caving in under the weight of squadmen or equipment. A tripod (Figure 6) a ladder laid horizontally, or an aerial ladder can be used very successfully and safely in this operation.

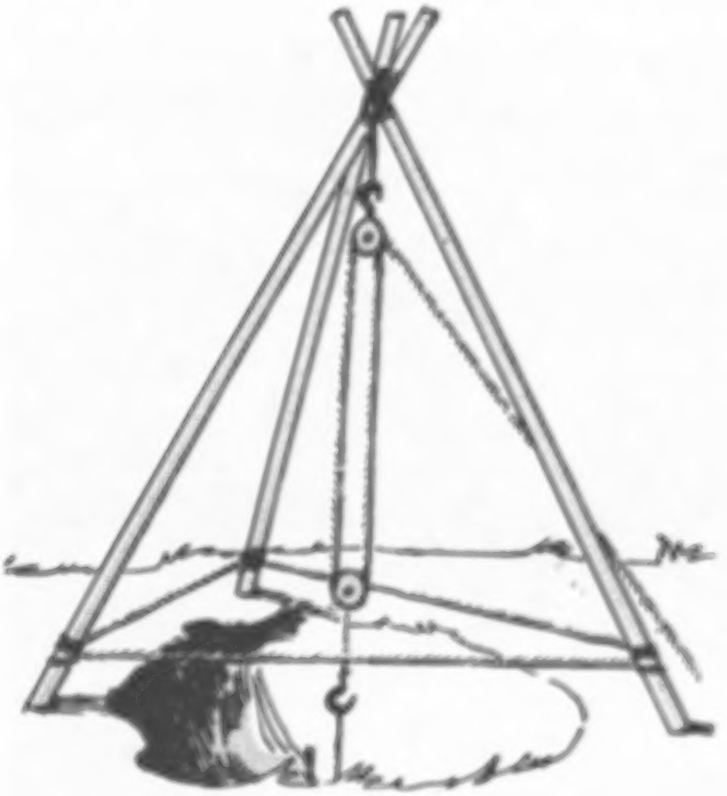


Figure 6
Use of tripod

HAZARDS TO THE SQUADMAN

In cave-in situations where gas lines may have been broken, rescue personnel must consider their personal safety. Accumulated toxic or asphyxiating gases can render squadmen helpless and unable to perform the rescue operations. Self-contained gas masks are indicated.

In emergency situations where hazards from utilities exist or may exist, call the utility company's emergency service for proper handling.

VICTIM CARE

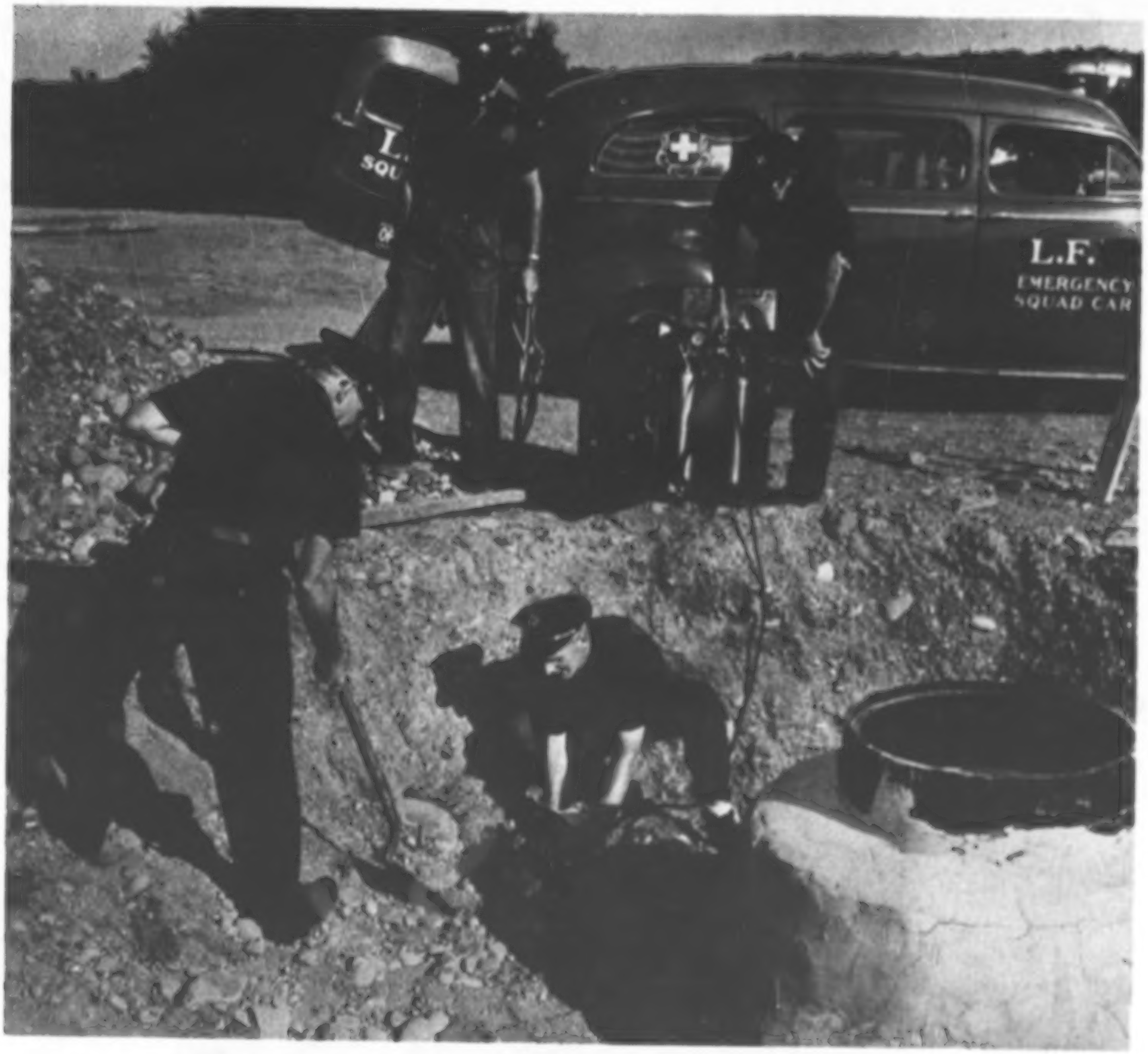
Victims may require resuscitation, first aid, or professional attention before being moved. Also some trapped victims may request spiritual assistance.

Figures 7 through 12 show a typical rescue operation involving a victim nearly buried under loose dirt.

Courtesy Loudonville Vol. F.D.

Figure 7

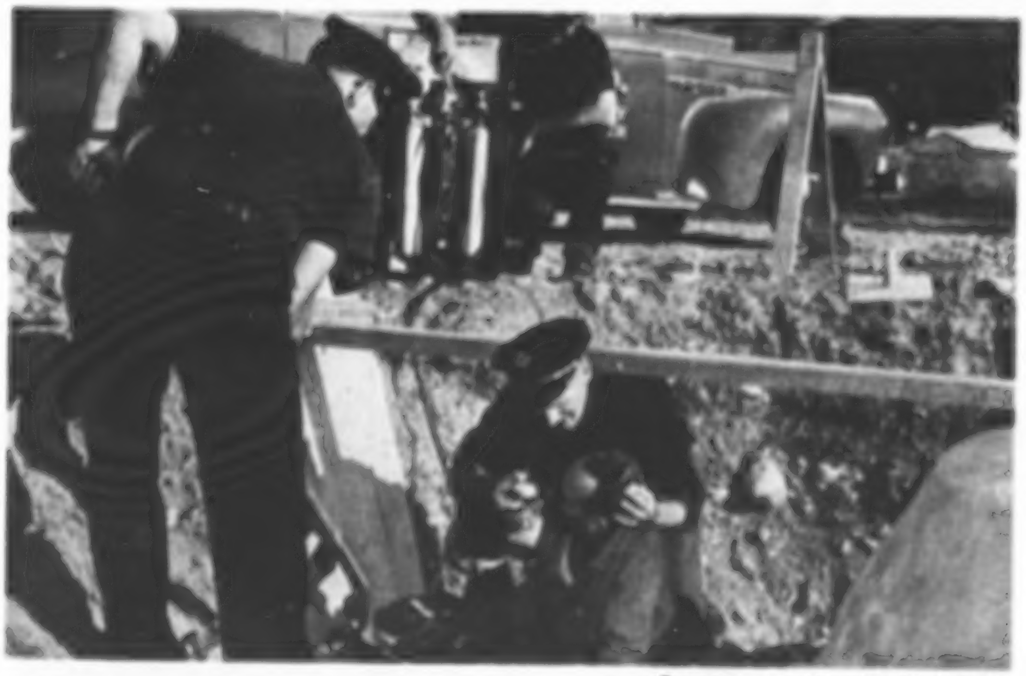
Two men were working in a trench. As one man climbed out to get a drink of water, the side of the ditch came rolling in, covering the man working at the bottom of the ditch. A workman ran to a nearby home and called the emergency squad.



Courtesy Loudonville Vol. F.D.

Figure 8

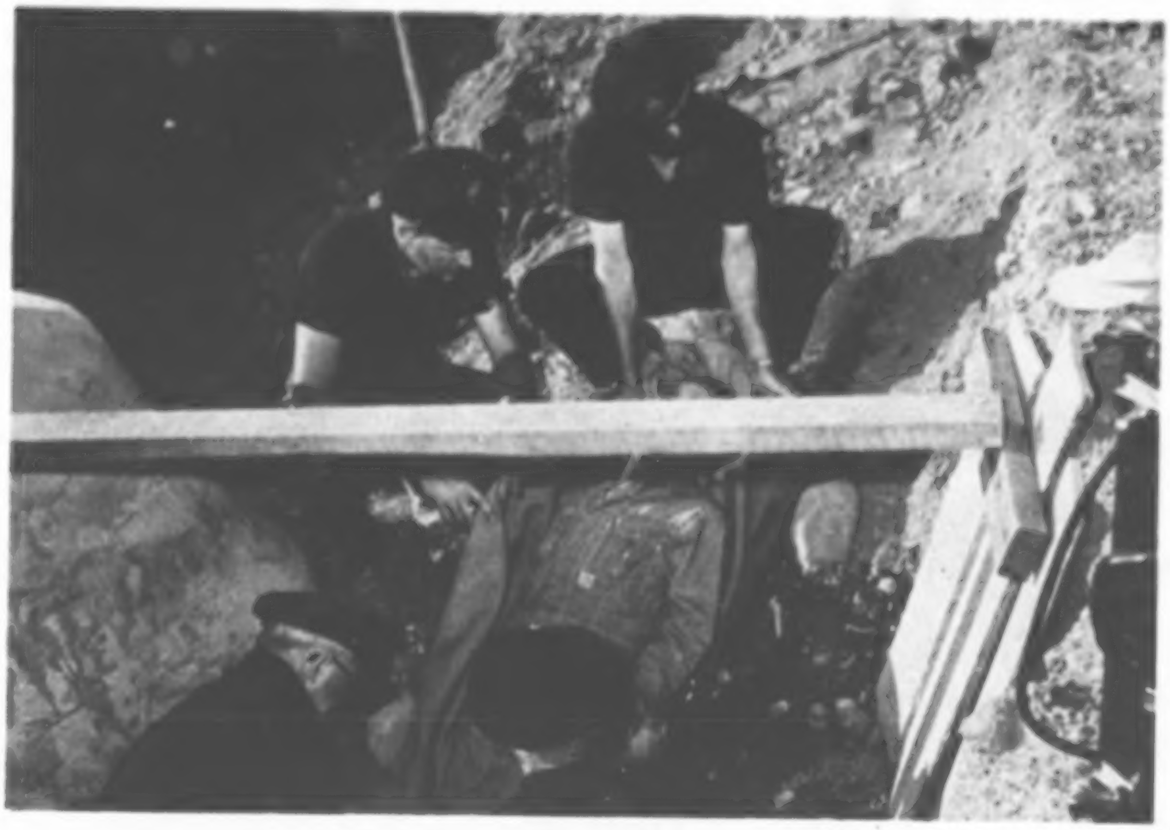
As the resuscitator could not be placed near the victim, the extension unit was set up. In this picture Squadman No. 1 opens the tank valve and connects the extension unit to the resuscitator. Squadman No. 2 turns the unit to resuscitation and places a face mask on the victim. (Squadman No. 2 is standing with feet apart, and to the rear of the victim, so he will not add more weight to the dirt covering the victim.) Squadman No. 3 starts removing the dirt from above the victim's chest area so the victim can breathe for himself. Squadman No. 4 brings a backboard and other equipment from the squad car.



Courtesy Loudonville Vol. F.D.

Figure 9

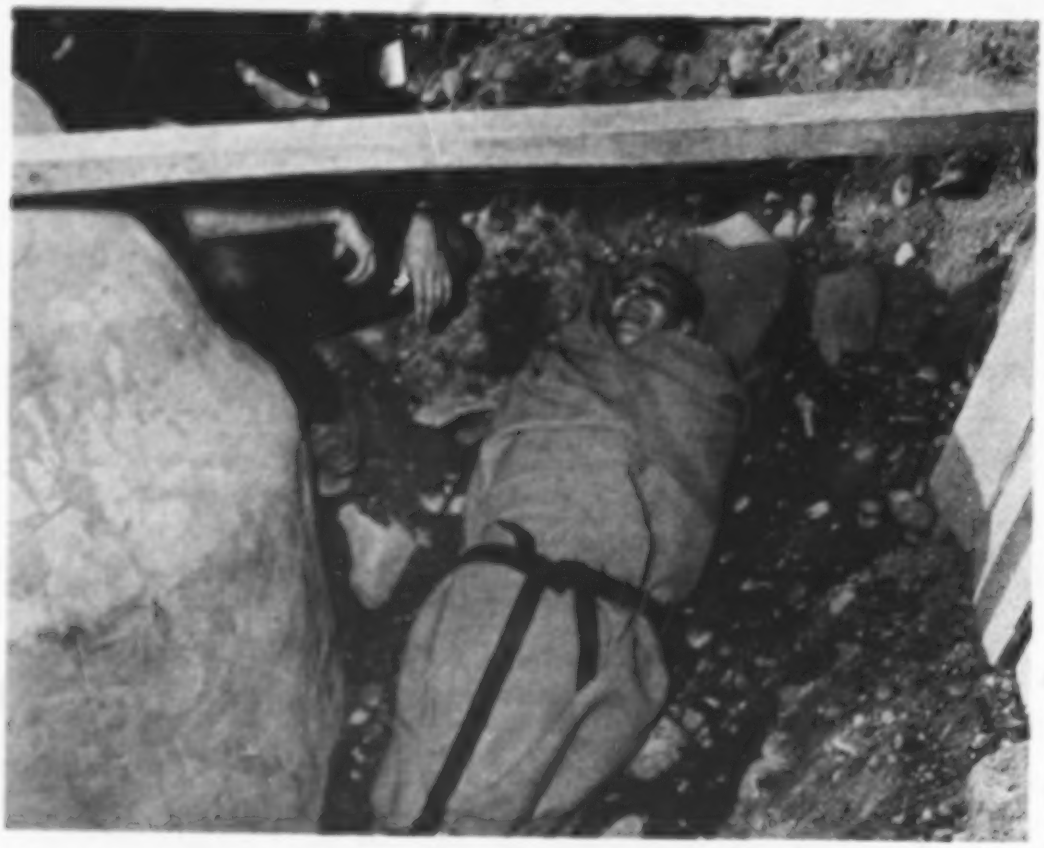
As the weight of the dirt is removed from the victim's face he is able to breathe for himself. Squadman No. 1 continues to supervise the machine. Squadman No. 2 adjusts the face mask and micro unit for inhalation. He supports the victim's head with his hand, and the victim's back with his knee and leg. Squadman No. 3 continues to remove dirt to free the victim. Squadman No. 4 has completed a shoring job to prevent farther cave-in.



Courtesy Loudonville Vol. F.D.

Figure 10

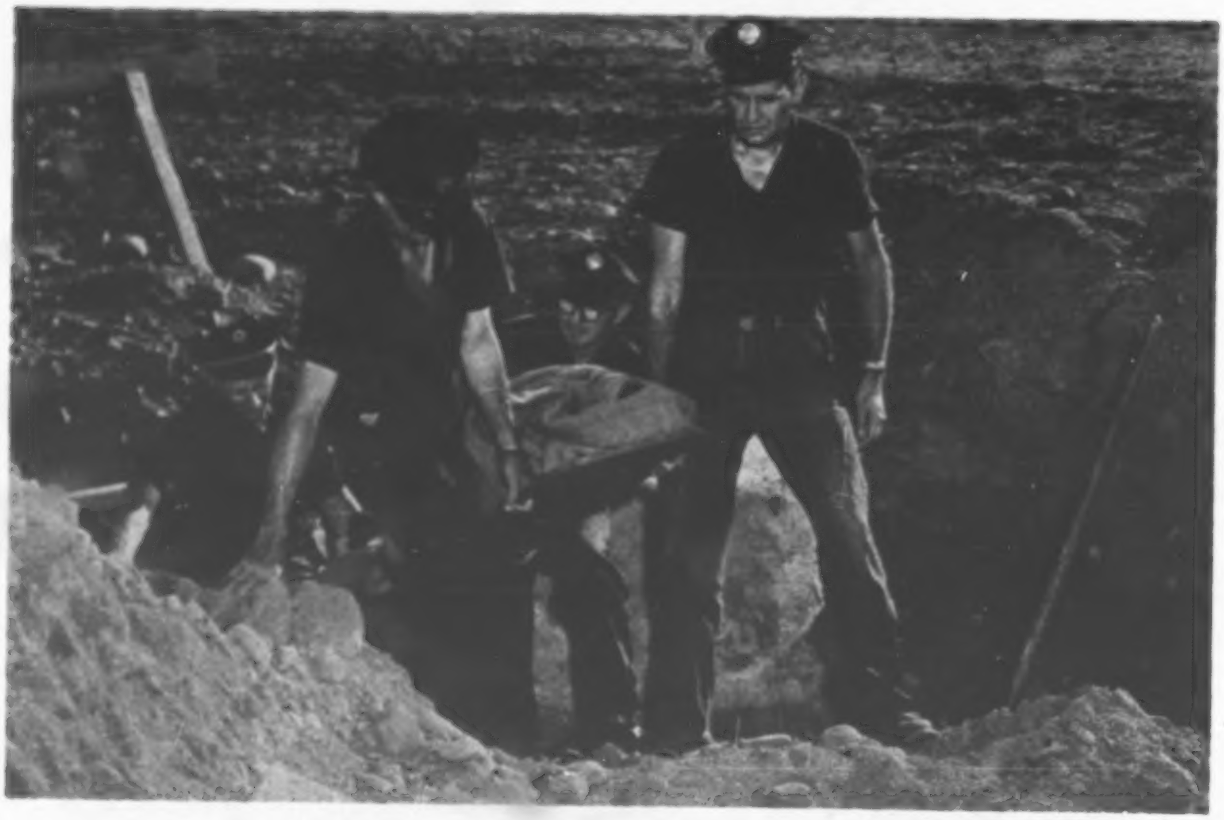
The victim is placed on a backboard.



Courtesy Loudonville F.D.

Figure 11

Web straps are used to secure the victim to the backboard.



Courtesy Loudonville Vol. F.D.

Figure 12

The victim is carried up out of the ditch. He was transported to a hospital, at a slow and careful speed.

CHAPTER XXII

WATERFRONT OPERATIONS

INTRODUCTION

Authoritative information tells us that most drowning victims must be brought to the surface within ten minutes if they are to have a reasonable chance to survive. Beyond that time, the efforts of the squadmen will be largely devoted to the matter of recovering the victim's body. Past records indicate that this is usually the case in most of the responses to this type of rescue emergency.

If, however, recovery is made within a reasonable length of time, manual or mechanical respiration should be started at once. It must be continued until the victim is either revived or pronounced dead by a physician or coroner. Such practice should not be treated lightly, as it has been reported that a man was revived after being submerged for thirty minutes.

It is a perfectly natural trait to persist in trying to recover the body of a drowned person, even though all hope of revival may be gone. However, the squadmen's responsibility stops when all hope of life is gone! The officer in charge should not lose sight of the fact that squadmen occupied in body recovery operations are not available to serve the living public.

All operations at the scene of a drowning should be directly in the charge of the emergency squad. This includes not only the recovery operations but the physical control of the scene as well.

Proper education and training will help to insure a maximum degree of safety for squadmen who must participate in waterfront operations. The material in this chapter is based on the assumption that its reader has had an approved course in water safety, sponsored by a nationally recognized authority or agency. Such instruction is absolutely essential to emergency rescue squad work. The following pages will describe some of the equipment and methods used in waterfront operations.

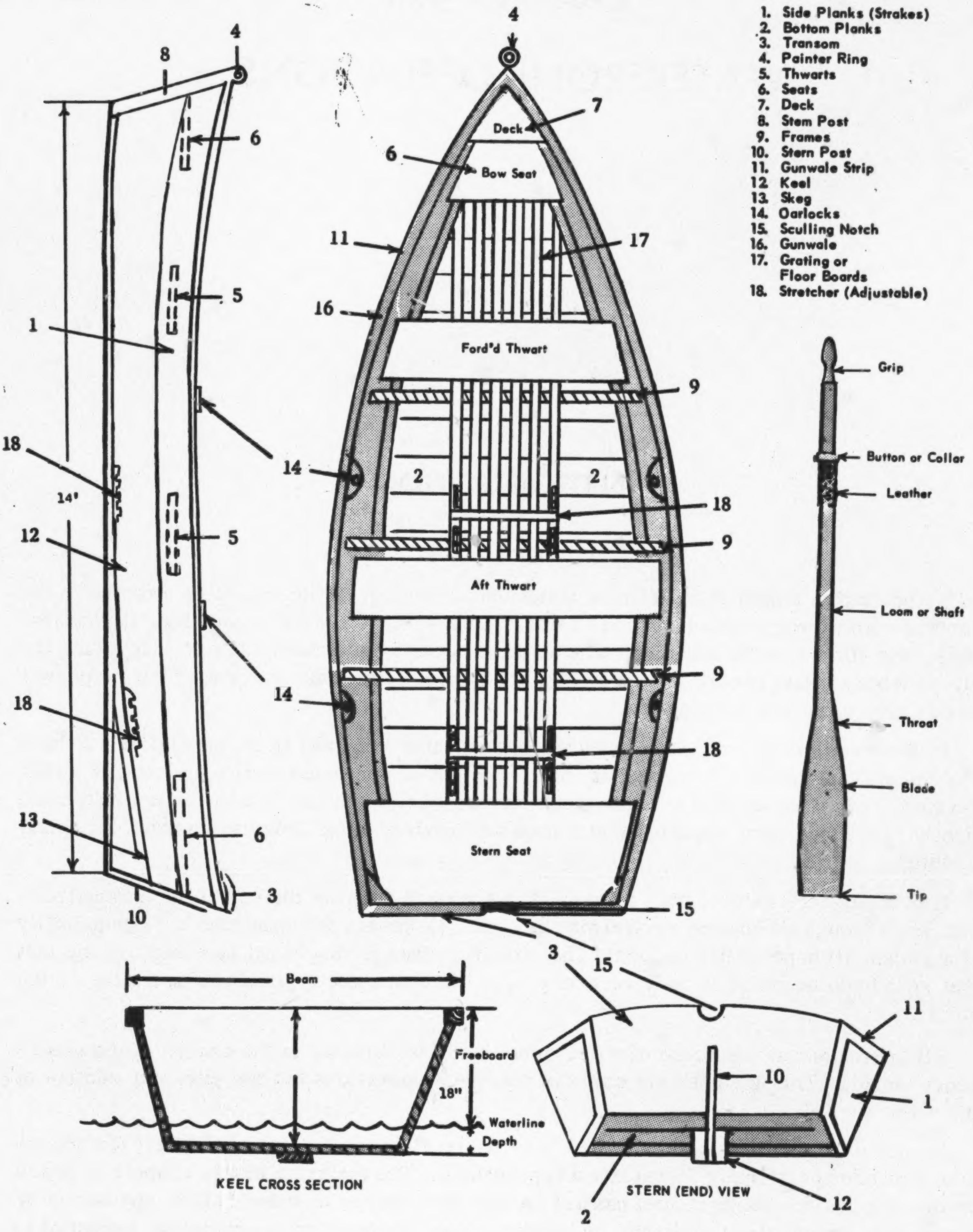

1. Side Planks (Strakes)
2. Bottom Planks
3. Transom
4. Painter Ring
5. Thwarts
6. Seats
7. Deck
8. Stem Post
9. Frames
10. Stern Post
11. Gunwale Strip
12 Keel
13. Skeg
14. Oarlocks
15. Sculling Notch
16. Gunwale
17. Grating or Floor Boards
18. Stretcher (Adjustable)
14'
Deck
Bow Seat
Ford'd Thwart
Aft Thwart
Stern Seat
Grip
Button or Collar
Leather
Loom or Shaft
Throat
Blade
Tip
Beam
Freeboard
18"
Waterline
Depth
KEEL CROSS SECTION
STERN (END) VIEW

Figure 1
Parts of a rowboat and an oar

BOAT HANDLING

Elementary boat handling is important to emergency squads. They are called upon to rescue stranded victims in time of floods as well as other emergencies where the only means of rescue is by the use of a boat.

While there is much material available on small boat construction, there is not a great deal to be found on the safe handling of small boats. This section, then, is intended to give some brief, basic information on boat handling and boating safety.

PARTS OF A ROWBOAT

Bow: The front, or forward part, of the hull.

Deck: The small triangular filling of wood at the bow of the boat, fitting level with and between the gunwales.

Frames: The narrow cross-sections, placed edgewise in the boat from gunwale to gunwale, down the sides and across the bottom, to hold the shape of the boat and to provide the form over which it is built; there are usually three or four frames.

Grating or Floorboards: Wood slats, cleated together in sections, to form a false flooring. They serve to protect ribs and planking and also to keep occupants' feet dry in a leaky craft.

Gunwales: (Pronounced gun'ls.) The top edges of the hull, on either side, from bow to stern.

Keel: The main backbone of the boat, extending along the bottom from the stem (at the bow) to the stern post.

Oarlocks: The metal crutches, pivoted in metal sockets on the gunwales of the boat, in which the oars rest in rowing; accepted patterns are either U-shaped or ring-shaped, with a metal shank to which a chain and toggle are attached to prevent loss.

Painter: The line, usually about 6 feet long, spliced to a ring in the bow and used for towing or for tying up the boat. A similar line in the stern is a sternfast.

Planking: Long narrow boards (also called strakes), laid up and fastened tightly to the ribs, edge to edge, and running lengthwise from bow to stern; they form the watertight outside covering of the hull, including the bottom.

Port: The left-hand side of the boat as you face forward.

Ribs: The narrow flat strips, usually steamed and bent to shape, spaced between the frames to aid in holding the shape of the boat; they also provide a foundation on which the outside planking can be fastened.

Risings: The strips of wood, secured to the frames and ribs, upon which the ends of the thwarts are secured.

Sculling notch: The half-round notch or depression in the upper edge of the transom, to hold the loom of a long oar for propelling the boat by sculling.

Seats: The small platforms or seats built into the stern and the bow of the boat.

Skeg: The small triangular piece of wood which fills the space between the end of the straight keel and the upsweeping stern of the hull; it serves to hold the stern on a steady straight course when the boat is rowed.

Starboard: The right-hand side of the boat as you face forward.

Stern: The back, or aft, part.

OARS AND THEIR PARTS

Oars: The flat-ended wooden levers by which a rowing boat is propelled.

Blade: The wide flat portion that is dipped in the water, when rowing.

Button: A ridge, built up of leather, at the inboard end of the leather, to prevent the oar sliding through the oarlock.

Grip: The handle portion held in the rower's hand.

Leather: A protective collar of horsehide attached to the loom at the point where the oar rests in the oarlock.

Loom: The long tapering shaft between the grip and the blade.

Throat: The narrowest part of the loom where it joins the blade.

Stretcher: A short crossbar held by two parallel cleats attached to the gratings or directly to the ribs, at suitable distance from each rowing position, to provide necessary foot-bracing for the oarsmen; crossbars are usually adjustable in any one of three notched positions, for length of legs.

Thwarts: The wide boards extending across the boat, located lower than the gunwales, for the oarsmen to sit on; there are usually a midship thwart, and f'wd thwart.

Transom: The broad flat plank, or planking, fitted to the extreme aft ends of the side and bottom planking, to close the stern end of the boat.

Figure 2 shows a rowboat in which rescue and first aid gear have been stowed, ready for emergency use.

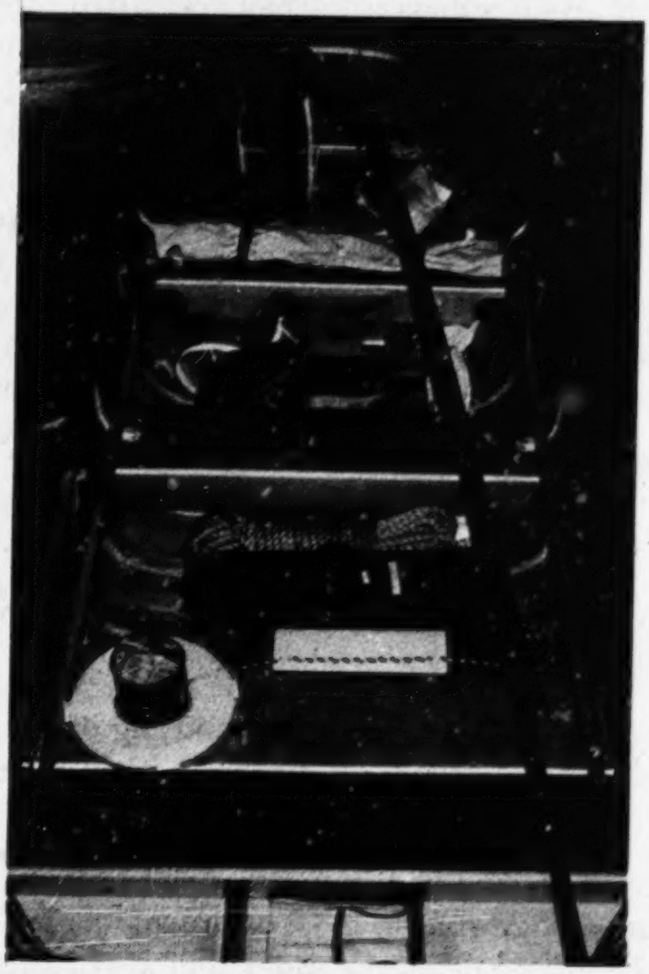


Figure 2

Rowboat equipped with rescue and first aid gear

BOARDING AND ROWING A BOAT

Making Ready - If at a shore, push the boat afloat by partially lifting the beached end. Before boarding it, make certain that the bottom is not resting on a stone or anything sharp that might injure the planking; also make certain that the bow is not so far ashore that you cannot "shove off" when your weight is aboard, and that the bow is not resting on anything that will make the boat "teeter" as you board it.

Before shoving off, the painter should be neatly stowed in the bow or on the bow-seat, oars lying fore and aft along the outer ends of the thwarts, with blades aft; oarlocks unshipped and hanging inside below the gunwales by their chains. Be sure all gear is neatly stowed and in its proper place.

If at a landing stage or dock, cast off and stow the painter, and bring the boat parallel alongside the front of the pier, holding it by the gunwale.

Boarding - Board the boat by stepping in the middle, on the bottom boards or on the gratings; do not step on the seats or thwarts. Keeping your weight low and with at least one hand constantly touching a gunwale, move to your position and seat yourself in the center of the seat or thwart. Passengers sit facing forward, oarsmen face aft. If rowing alone and the boat has two rowing positions, use the aft one.

Seating the Oars - Adjust the stretcher in the proper notch to suit the length of your legs. Ship the oarlocks by raising them until the chain feeds downward through the socket and until the shank of the lock itself is firmly seated in the socket. Lift each oar at its balancing point, drop the loom into the oarlock and slide the oar outboard until the button bears against the oarlock; or, if there is no leather or button, until the oar feels "balanced" in the lock. If oars are of correct length for the boat, the ends of the grips will be very near touching, or they may actually overlap up to 2 or 3 inches when the oars are held horizontally.

Rowing Position - The correct rowing position is important for efficiency and endurance. Seated erect, face squarely astern. Head should be up, feet together and braced against the stretcher, knees together and slightly bent. It the boat has no stretcher, feet may have to be somewhat spread to brace against a frame or rib; knees would be correspondingly spread and slightly bent. Hands grasp the oar grips with the knuckles uppermost; thumbs may encircle the underside of the grips, or may cap the ends, but should not rest on the upper surface of the grips alongside the fingers. (See Figure 3.) Elbows should hang close to the body, without strain.

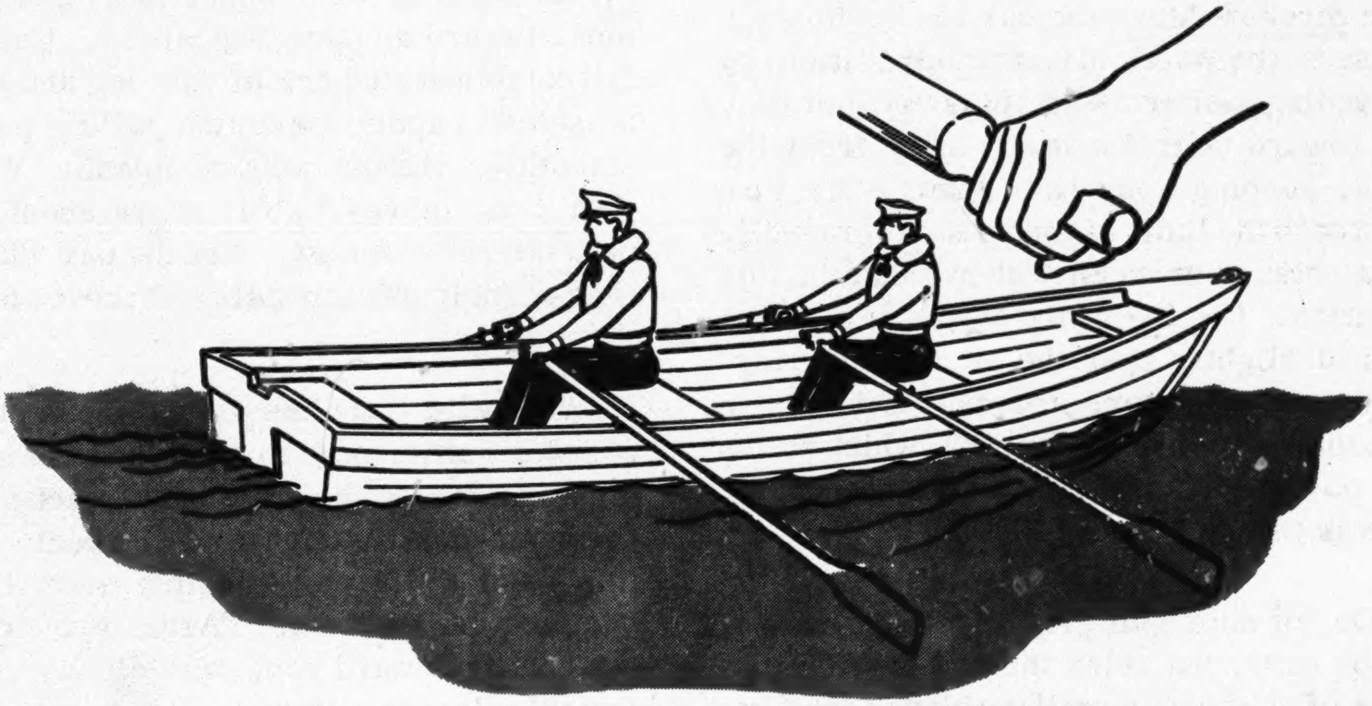


Figure 3

Rowing position and grip

With both oars resting horizontally in the oarlocks and their length at right angles to the centerline of the boat, turn them until the plane of the blades is absolutely vertical. Then adjust your hand grasp without disturbing the vertical setting of the blades, so that your wrist joint is absolutely straight in a horizontal plane with your forearm. This is your basic grip of the oars.

Without relaxing or shifting your grip, bend your wrists in a manner that will cause your hands and knuckles to rotate upward and toward you; (in rowing parlance this action is termed "dropping" the wrists.) This will tip the oar blades about 30 degrees into "feathered" position, with the forward edge of the blade higher than the aft edge. If you now raise your hands slightly to lower the blades until they are skimming just an inch above the water, you are in the position "Rest Oars" or "Oars."

To prepare for rowing, glance over your shoulder toward the bow, to make certain that the way is clear ahead of you.

The Stroke - Move the oar blades forward close to the water in feathered position, by extending your arms as you sway your body aft toward your knees. Sway from the hips, keeping your back erect. As you approach the limit of your reach, gradually straighten your wrists; then pause in this position. The flat of the blades is thus returned slightly past the vertical setting, close to the water, and everything is in readiness to make the "catch", which starts the power portion of the stroke. This position is that of "ready".

Do not shift your grip or release control of the oars, but relax the downward pressure of your hands until the blades drop into the water as far as their own weight will immerse them. (See Figure 4.) As you feel the blades "catch" begin to apply power by moving your whole upper body, from the hips, toward an upright position. Use the full combined strength of your leg and back muscles to apply maximum pulling power smoothly, without jerk or splash. While your body moves, your arms should be maintained extended. Let the oar blades float at their own normal depth; never force them deeper.

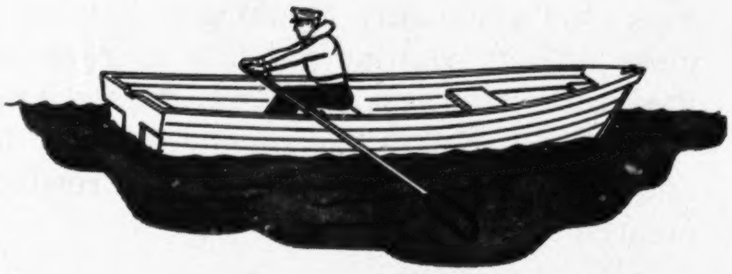


Figure 4

The catch

When your body has passed the vertical position sufficiently to tighten abdominal muscles perceptibly, you have reached the maximum desired degree of "layback". At this point the arms smoothly start their contribution of power. Arms are drawn powerfully toward you, with elbows comfortably close to your body, until your hands are practically touching your chest. (See Figure 5.)

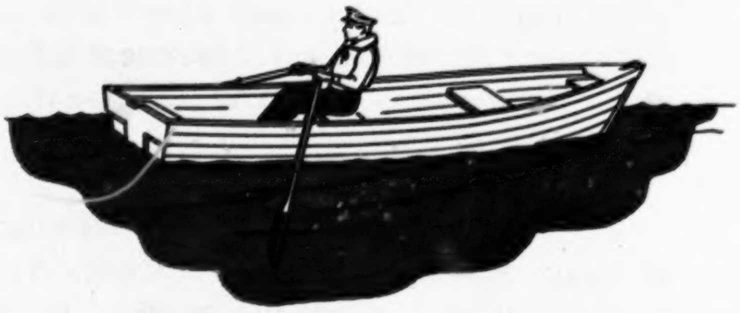


Figure 5

Pull nearly completed

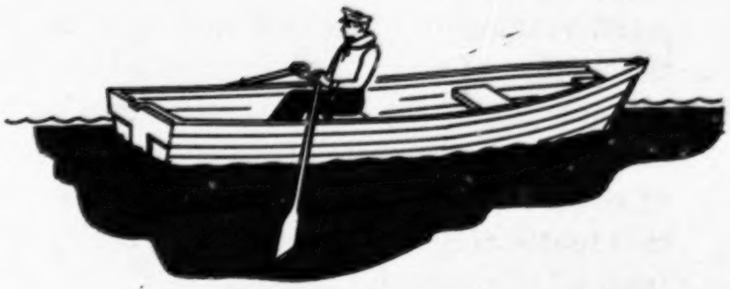


Figure 6

The recovery: blades are feathered

The oars now are slanted toward the stern at such an angle that the blades have slipped clear of the water without tossing any of it in a spurt or splash. This is the completion of the "power portion" of the stroke.

The recovery is the final phase of the stroke cycle. This is done with the blades in "feathered" position, to reduce wind resistance; also to assure the blade gliding over the crests of whitecaps in choppy water. (See Figure 6.) As the "pull" or "power" portion of the stroke is completed, drop your wrists smartly to flip the blades into feathered position. Smoothly and simultaneously with the dropping of your wrists, extend your arms. As the arms approach their full extension, start the sway of your body from the layback position, through the vertical position and toward your knees. Level your wrists as you attain your maximum reach without rounding your back. You are now in the "ready" position, poised with blades facing squarely for the "catch" of the next stroke.

Correcting Course - The oarsman should correct his boat's course by pulling somewhat harder on one oar than on the other, without any interruption in the smooth rhythm of the stroke.

A more drastic correction can be made --as when a heavy gust of wind or a sudden cross-current veers the bow off course--by poising one oar in "rest" position, or by "trailing" it, while one or more strong pulling strokes are taken with the other oar.

Hold - To stop a boat, drop the blades into the water at the end of a stroke. Then sit upright, hold one knee beneath the thwart (as a purchase), press firmly toward the stern with your hands, and thus gradually force the blades forward in the water against the forward motion of the boat.

Stern All - To propel the boat astern, after stopping it, repeat and continue the sternward pushing action with your arms, adding the weight of your body to the final portion of each push. In choppy water the blades should be feathered on the recovery portion of each of these "backwater" strokes, but this feathering is done by raising the wrists, instead of dropping them.

Turning - When it is necessary to make a sharp turn and at the same time retard the progress of the boat, the action is opposite to the foregoing. The turn is made by executing a backwater stroke with one oar, while "resting" or "trailing" the other.

Approaching a Landing - The turning technique is used when coming alongside a landing. The approach and momentum are judged by looking continuously over one shoulder. At the right moment the oar on the landing side is deftly unshipped and boated; the other oar then is used for backing water to just the degree necessary to slide the boat to a broadside, motionless position at the landing.

Pivoting - Turns are executed by backing water with one oar, while simultaneously pulling with the other.

ADVICE TO THE BEGINNER

Beginning oarsmen often have trouble with one oar: it repeatedly fails to grip the water, or slices too deep and jumps out of the oarlock. Either occurence is termed "catching a crab". An incorrect grip on the oar may be the cause. Check your grip while holding the plane of the blades absolutely vertical; if necessary, readjust your hand grip. A "crab" may also be caught because of tenseness and consequent failure to level your wrists equally, as you make the "catch".

As you become an experienced oarsman, you will develop the ability to check your grip during each pulling stroke, by the "feel" of the blade as it bites the water; any slight adjustment is then made during the rowing rhythm.

The good oarsman periodically glances over one shoulder, without breaking the rowing rhythm, to make certain that the course ahead is clear of any other traffic.

Take your time. Think out each move before attempting it. Then move slowly, easily, in a relaxed manner. With persistent practice you will become an excellent oarsman. Keep your full attention on what you are doing. Don't dip the blades too deep: the water should not wet the shaft above the throat. Keep your hands low. Don't lift the blades too high on "recovery"; they should just clear the water. Keep your head up. Get a full breath of air every stroke. Pull evenly; a zig-zag course is caused by uneaven pulls.

BOATING SAFETY

All boats out on the water should be under watch of a guard at all times. This guard should remain on shore.

At night always carry a bright flashlight or lighted lantern visible all around if rowing on a waterway where other vessels or boats are used. The light should be shown at the approach of other boats.

Keep out of the way of power boats of all kinds in ordinary water traffic. Power boats carry white lights in the stern only or in bow and stern; sailboats do not. Green lights are on the starboard, red lights on the port side.

Waves from a large power vessel can upset a small craft that is not being handled properly. Keep at least 300 feet away from such vessels until the stern has passed. Head your boat into an approaching wash and remain stationary until it subsides.

Any boat equipped with a motor or other sinkable dead weight should have airtight compartments capable of supporting this weight.

All metal craft should have airtight compartments to float their occupants if swamped. Metal boats should be swamped and tested every two weeks for pin-hole leaks in their airtight compartments.

If two squadmen must exchange seats away from shore, first "boat the oars". Then one man sits forward on the bottom; the other crouches with one hand on each gunwale, passes alongside, and is seated. Then the man on the bottom moves to the vacated place.

When dropping or retrieving the anchor, a squadman should be sitting in the boat. If he is standing, he may lose his balance.

Two small persons can row in unison sitting in the same seat (double banked). Each pulls one oar. A better way is single-banked sweep rowing, with one man in each seat, pulling one oar.

Whether they use one or two oars each (called "pair-oar rowing"), the two oarsmen should keep absolutely together. The aft oarsman or "stroke" sets the rhythm.

In waves or choppy water row with regular, steady strokes. If possible take the waves at a slight angle rather than directly bow-on or stern-on. Keep a level boat by spreading weight evenly. In a high wind, seat passengers flat on the bottom and keep the bow headed into the wind.

If one oar is lost, face the bow and use the other as a paddle or scull.

It is a violation of good seamanship and unwise to do the following:

1. Overload a boat by taking more people than its marked capacity.
2. Abuse an oar by splashing water with it, digging in the sand with it, or using it as a fender.
3. Expose yourself to injury by standing in a boat, rocking it, or skylarking in a boat.
4. Deliberately or carelessly allow your boat to bump another or crash the landing.
5. Create a false alarm by needlessly calling "HELP", or by making a sound that can be thus interpreted.
6. Risk being run down through failure to carry a light, if out at night on waters used by other craft.

OPERATION AT SCENE OF DROWNING

SQUAD SAFETY

It is well at this point to stress certain factors pertinent to the safety and welfare of the squadmen. Diving into the water is indicated when the victim can be seen and is moving, or when there is substantial evidence that the victim has been under the water only a few minutes. It is obvious that only trained and qualified water-safety men should be selected for this assignment.

The use of life jackets should be emphasized. They are standard equipment for squadmen to wear during all boating operations. This rule should apply to swimmers as well as non-swimmers, especially when entering swift or rough waters.

A squadman should be assigned to shore duty, and should remain there, as long as squadmen are working in boats. His main responsibility will be to keep the occupants of the boats under surveillance. In the event they run into trouble or encounter some difficulty, he can quickly secure help to assist them. He can also gather information from witnesses on shore which can aid the boatmen in their size-up and search.

SIZE-UP

Proper size-up at the scene of a drowning, before and during the operation, will be of great assistance in making a rapid and successful recovery. In making the size-up, the squadman in charge should consider the following factors:

1. How long the victim has been submerged
2. Where he was last seen
3. How the victim was dressed (in swim suit or clothed)
4. Survey of the body of water as to:
    - Character of bottom
    - Currents
    - Snags and obstructions
    - Depth and width of water
    - Conditions of banks (undergrowth, trees, etc.)
    - Direction of wind

GENERAL INFORMATION ON DROWNED BODIES

A body will remain in the immediate vicinity of where the drowning occurred. Even though there is a strong current on the surface of the water, the body will not move very far from the spot where the victim was last seen. It has been noted that a body in a swimming suit, when sinking, will not be more than 1-1/2 times the depth of the water from the spot.

Example: Water is 20 feet deep.
1-1/2 x 20 = 30 feet from the spot.

Sometimes bodies of victims who are very fat and bodies of small children do not sink after drowning, but remain floating on the surface. A body will rise to the surface when enough gas is formed in the intestinal tract to make the body buoyant. The time needed to generate the necessary gas will depend on the temperature of the water and the content of the victim's stomach when drowned. In summer, the average time is from 18 to 24 hours. However, in winter, or when the water is very deep and cold, the time will be much greater. A body will not rise suddenly from the bottom, but gradually as more gas is formed and the body becomes buoyant. After the body rises to the surface, its movement is affected by the current or wind; it may be found several miles downstream.

A victim drowning in a rapids probably will be carried to the first deep hole downstream. If manpower is available, it is advantageous to send one detail downstream to search the eddies and center of the stream.

Equipment carried in Rescue Boats

Oars (2 sets)
Anchor
Life jackets
Ring buoy
Torpedo buoy
Flashlight with extra batteries
Pike poles
Drag hooks
3/4-inch rope, 100 feet
3/8-inch rope, 100 feet
Life gun and extra line

DRAGGING

In the early stages of any body search, dragging and probing with grappling irons, grappling hooks, and pike pole irons are the usual means employed. Even under the best circumstances, dragging is a blind operation.

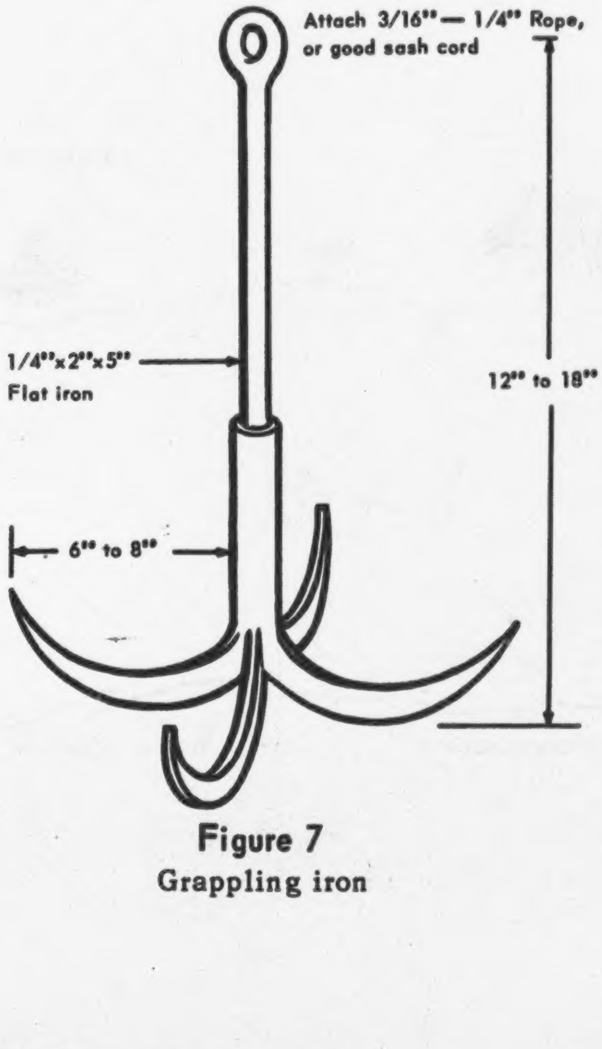


Figure 7
Grappling iron

Very useful types of grappling equipment can be made by a squad. These include: grappling irons, pike pole irons, and grappling hooks.

The grappling iron shown in Figure 7 is not too practical for rescue work, but may be used in very deep water, not only for body recovery but for equipment, etc. The iron weighs from five to ten pounds.

The pike pole iron is the only type that can be used in waters with stumps. (See Figure 8.) The pole should be in four-foot sections and not to exceed twenty to twenty-five feet in length.

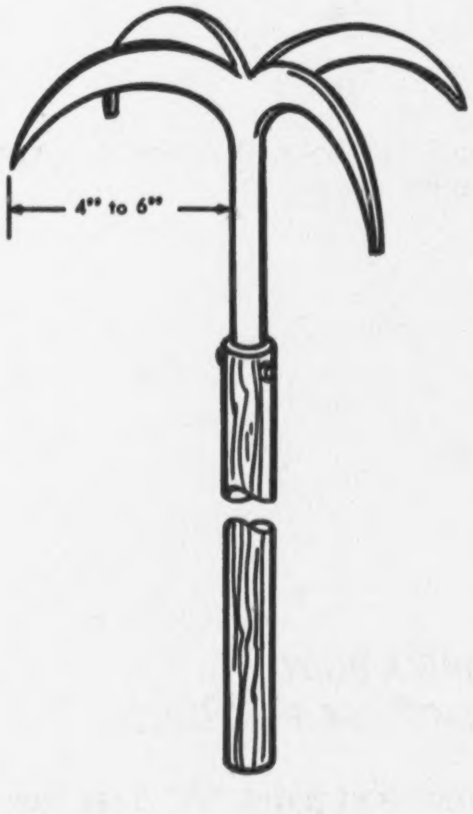


Figure 8
Pike pole iron

Grappling hooks are made of No. 9 iron wire. Two pieces 18" long are bent in half and twisted as four strands, forming an eye at one end and four prongs at the other end. Space the hooks along lines and attach the lines to a tow bar as illustrated in Figure 9, on the next page.

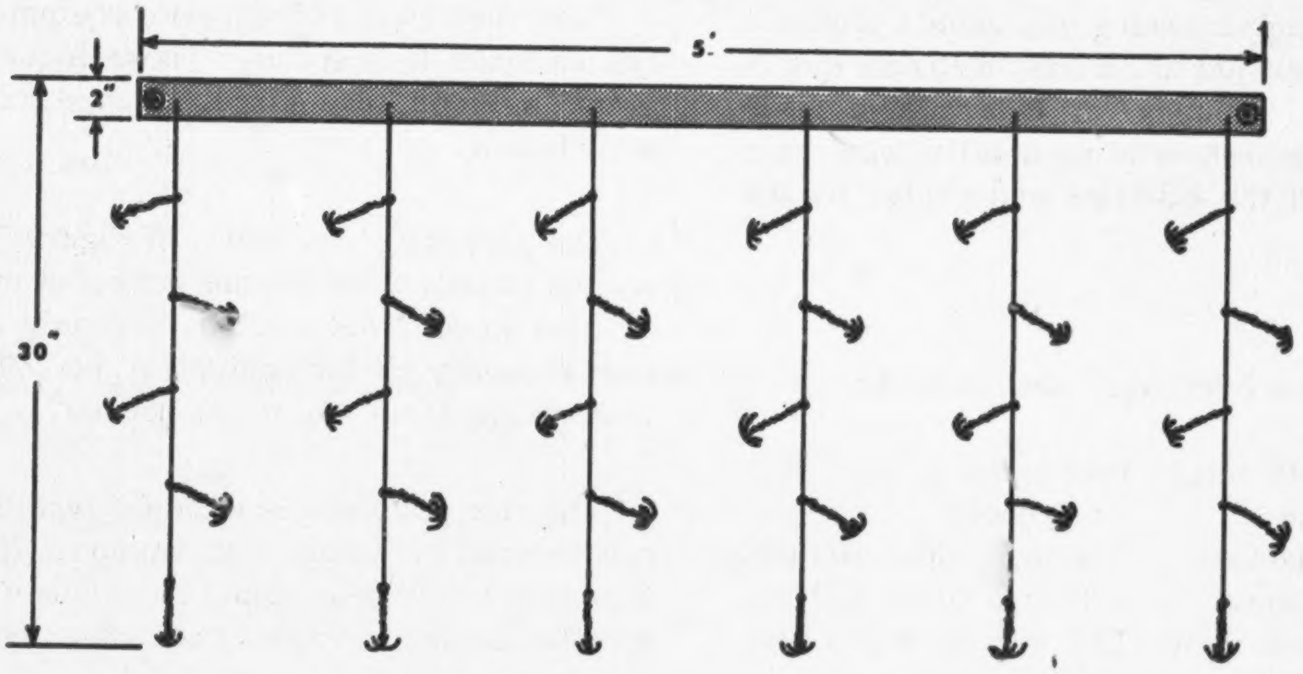


Figure 9

Grappling hooks on a towbar. A cable or chain attaches to each end of the towbar, for dragging operations.

LOCATING A BODY FOR GRAPPLING PURPOSES

A witness at point "A" last saw victim in line with tree "X". (See Figure 10.)

A witness at point "B" last saw victim in line with tree "Y".

Then, by "drawing" imaginary lines between point "A" and landmark "X", and between point "B" and landmark "Y", the squadman can locate the point where the lines cross or intersect. Search for the body should focus on that point.

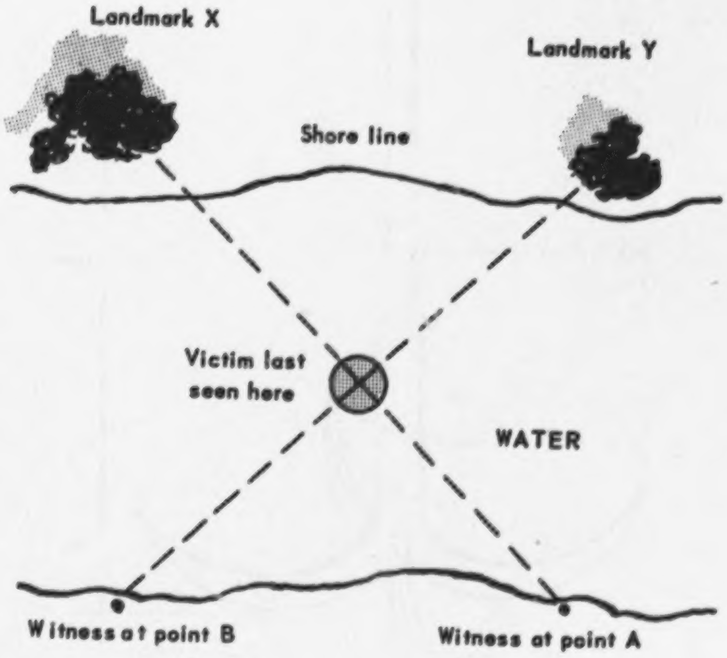

Landmark X
Landmark Y
Shore line
Victim last seen here
WATER
Witness at point B
Witness at point A

Figure 10
Locating a body

DRAGGING METHODS

There are many dragging methods which may be used; some of the more successful ones are described here. Grappling may be done from shore to shore, dock to dock, boat to shore, or boat to boat.

The following procedure is used in shore-to-shore grappling. (See Figure 11.)

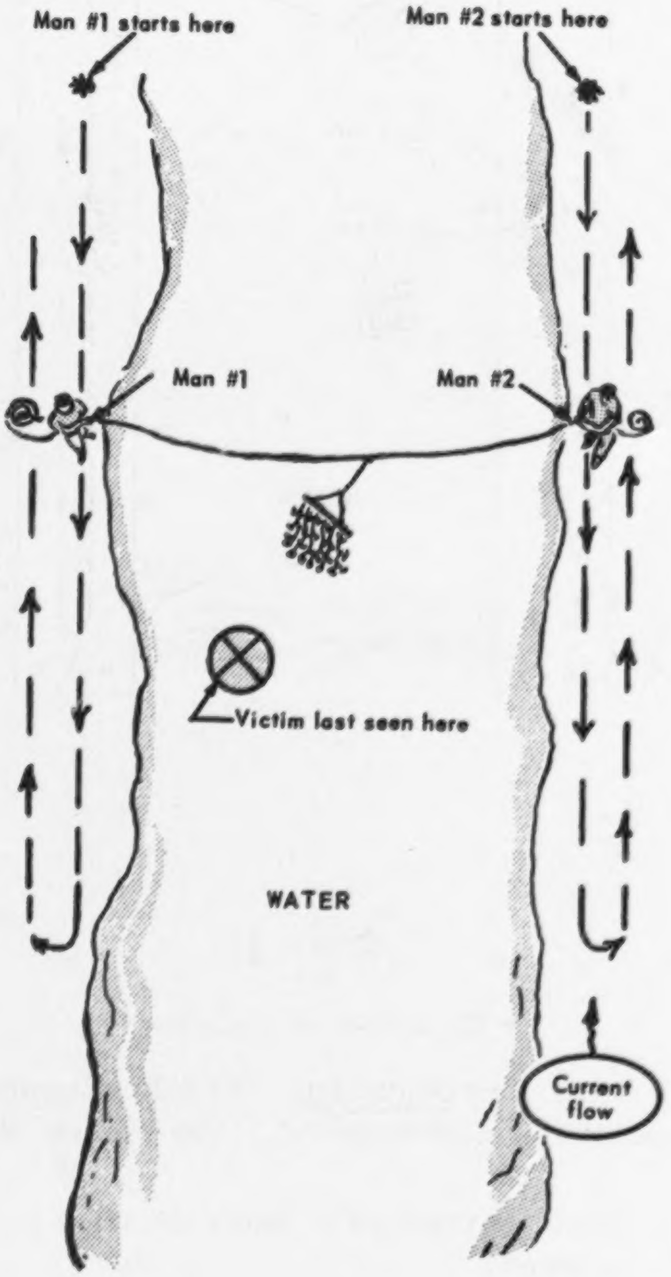


Figure 11

Shore-to-shore grappling. In flowing water a body may be carried with the current a short distance, Note that the dragging operation here starts downstream from where the victim was last seen.

Shore-to-Shore Grappling -

1. The rope should be more than twice the width of the area to be covered.
2. Secure hooks to center of rope.
3. Squadman #1 will drop hooks straight down until they hit bottom. He then signals #2 squadman to draw hooks slowly toward him, allowing them to drag the bottom across the entire width of the body of water.
4. If nothing is hooked, #2 side-steps one-half the length of the grappling bar in the direction the victim was last seen.
5. #1 then side-steps the same distance in the same direction.
6. #2 then lowers the hooks straight down to the bottom, and signals #1 to pull hooks slowly to him.
7. This procedure is continued until the entire area is covered. Procedure is then reversed so area will be covered twice.
8. If the body is not then recovered, the area should be extended in both directions, and the procedure repeated.

Boat-to-Shore Grappling - Figure 12 shows the recommended procedure.

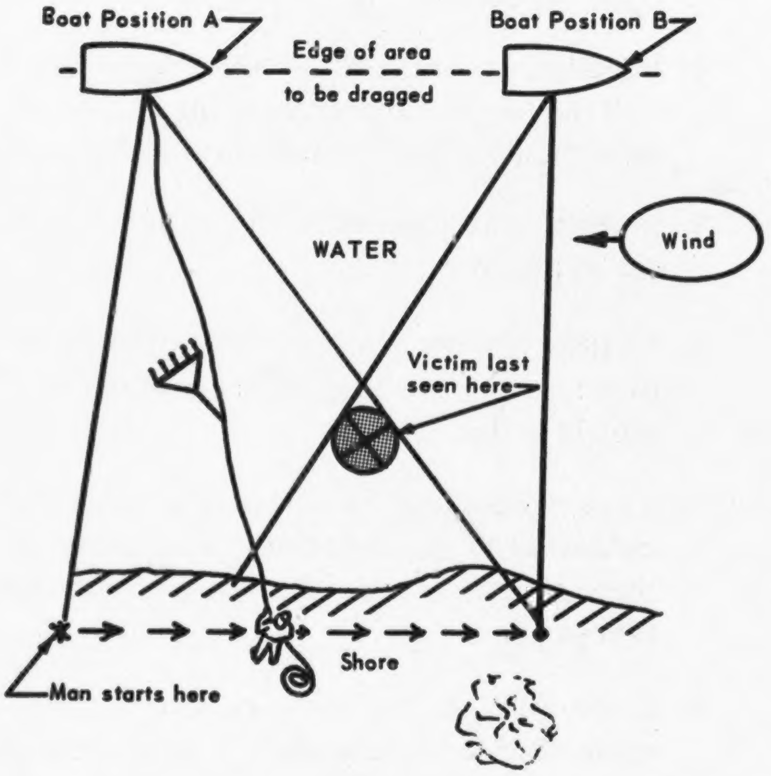

Boat Position A
Boat Position B
Edge of area to be dragged
WATER
Wind
Victim last seen here
Shore
Man starts here

Figure 12

Boat-to-shore grappling

1. The boat must be anchored securely.
2. The man on shore does all the moving, side-stepping one-half the length of the grappling bar.
3. If the victim is not hooked after procedure from boat position A, the boat should then be moved to position B, and anchored securely. The procedure is then repeated from this new position.

Dock-to-Dock Grappling - The procedure is the same as in shore-to-shore grappling. (See Figure 13.)

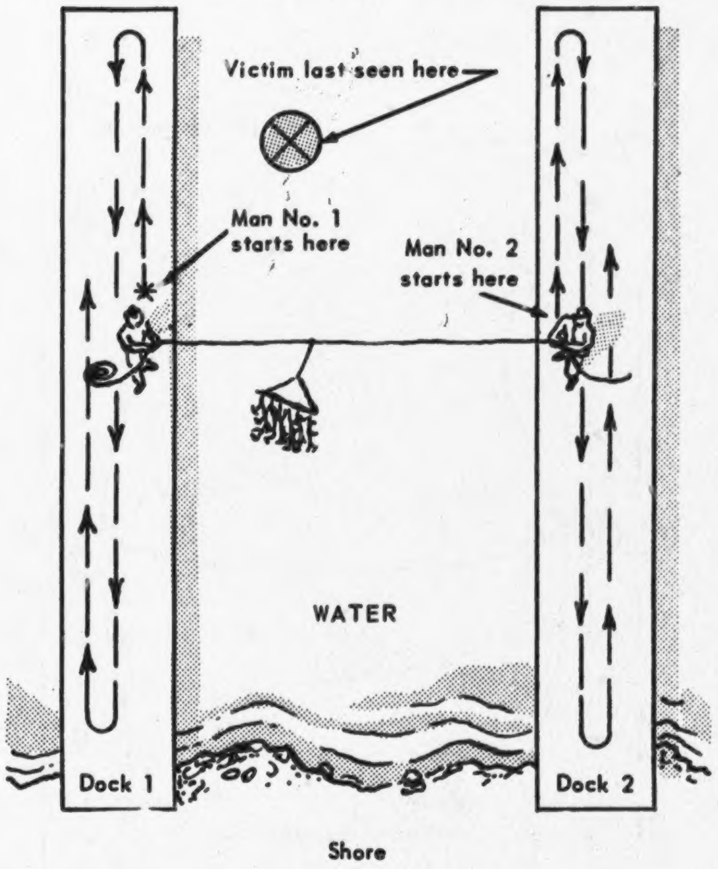

Victim last seen here
Man No. 1 starts here
Man No. 2 starts here
WATER
Dock 1
Dock 2
Shore

Figure 13

Dock-to-dock grappling

Boat-to-Boat Grappling - The following procedure is recommended. (See Figure 14.)

1. Place four buoys to mark the area to be covered.
2. Boats should be anchored from bow and stern.
3. Boats should be headed in the same direction.

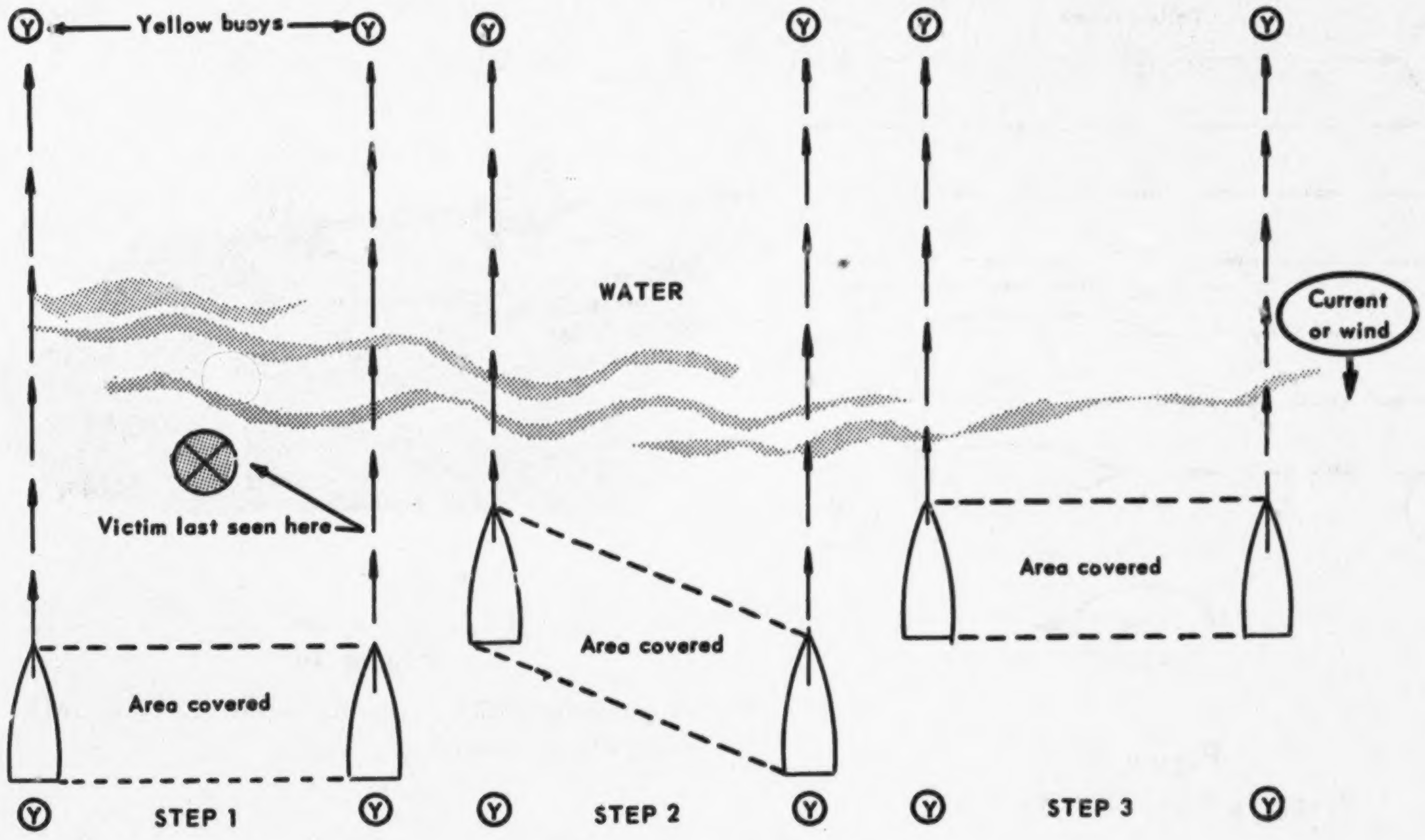

Yellow buoys
Y
WATER
Current or wind
Victim last seen here
Area covered
Area covered
Area covered
STEP 1
STEP 2
STEP 3

Figure 14

Boat-to-boat grappling

4. Boats should be broadside to the area being dragged at all times.
5. The entire length of the boat is grappled. Boat #1 moves forward one boat length. Then boat #2 moves in line with boat #1.

GRAPPLING FROM A MOVING BOAT

The least advantageous method of grappling is from a moving boat. The movement of the boat cannot be controlled perfectly, so the entire bottom of the area may not be covered.

When grappling from a moving boat, it is best to move with the current. This will keep the hooks on the bottom. If the current is very strong the oarsman should back water; otherwise the movement of the boat will be so swift that it may pull the hooks off the bottom.

The squadman using the hooks should kneel on the stern seat of the boat and operate the hooks over the stern of the boat.

In rough waters a motor may be used. It is best to use the motor to move the boat upstream with hooks out of the water. The boat should then be allowed to float slowly downstream with hooks on bottom.

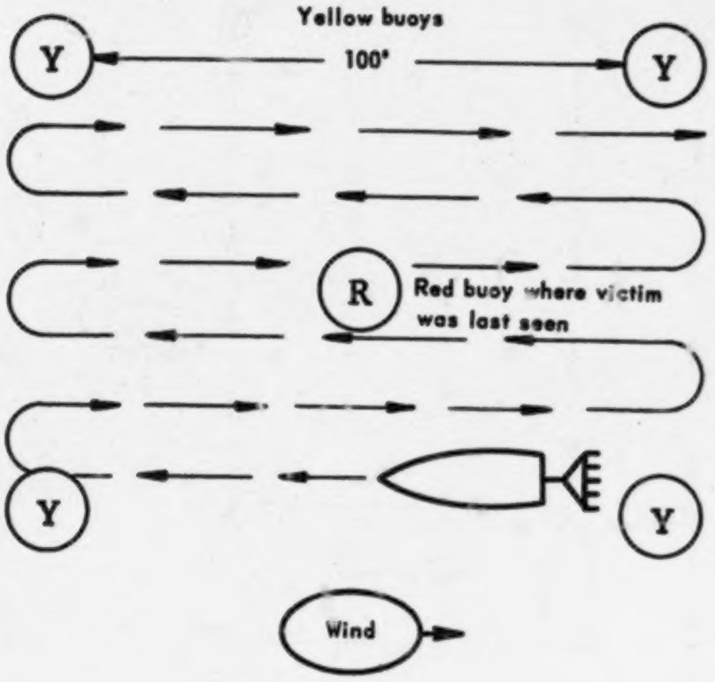


Figure 15
Dragging from a moving boat

For dragging from a moving boat, the following procedure is recommended. (See Figures 15 and 16.)

1. Upon arrival at the scene, remove all equipment from the boat that is not needed to start operations.
2. Launch boat (with two men).
3. Place red buoy where victim was last seen and start dragging at once.
4. If body is not recovered within one hour, place four yellow buoys in a square approximately 100 feet apart, and start systematic dragging operations.
5. Row boat into the wind; it is easier to keep on a straight course.
6. Do not start rowing until hooks hit the bottom.
7. Hold the dragging rope in your hand at all times, so you can feel when an object is hooked. The slack end of the rope should be tied to the boat as a precaution against losing hooks if the rope is pulled from your hands.
8. Boat must be rowed slowly and must not get too far ahead of the hooks.

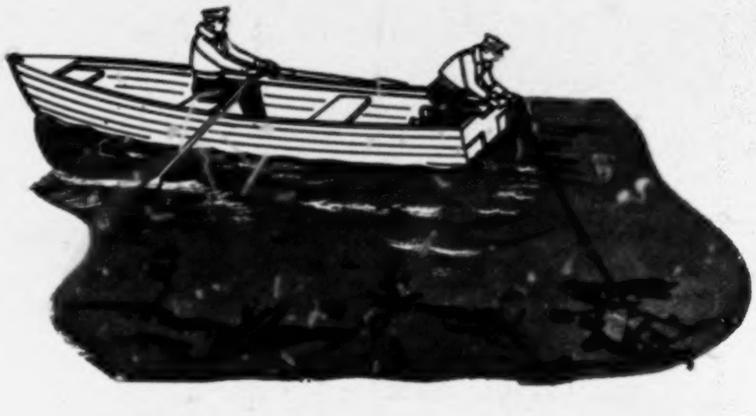


Figure 16
Grappling hooks correctly used. They should drag the bottom.

OUTBOARD MOTORS

While the use of a motor on a boat is not recommended for dragging operations, it can be used successfully by squadmen under certain conditions.

Advantages

1. Time and effort are saved in getting to the spot to start dragging operations.
2. Time and effort are saved in rescue of victims stranded in flood waters.

Disadvantages

1. Motor gets in the way of dragging operations.
2. Motor moves boat too swiftly for dragging, pulls hooks off bottom.
3. Motor is sometimes difficult to start.
4. Time is lost refueling motor.
5. Mechanical failures occur, such as shearing off of the pin or motor stoppage.

DRAGGING WITH SEVERAL BOATS

Sometimes several boats are used in a dragging operation. Figure 17 shows a recommended procedure.

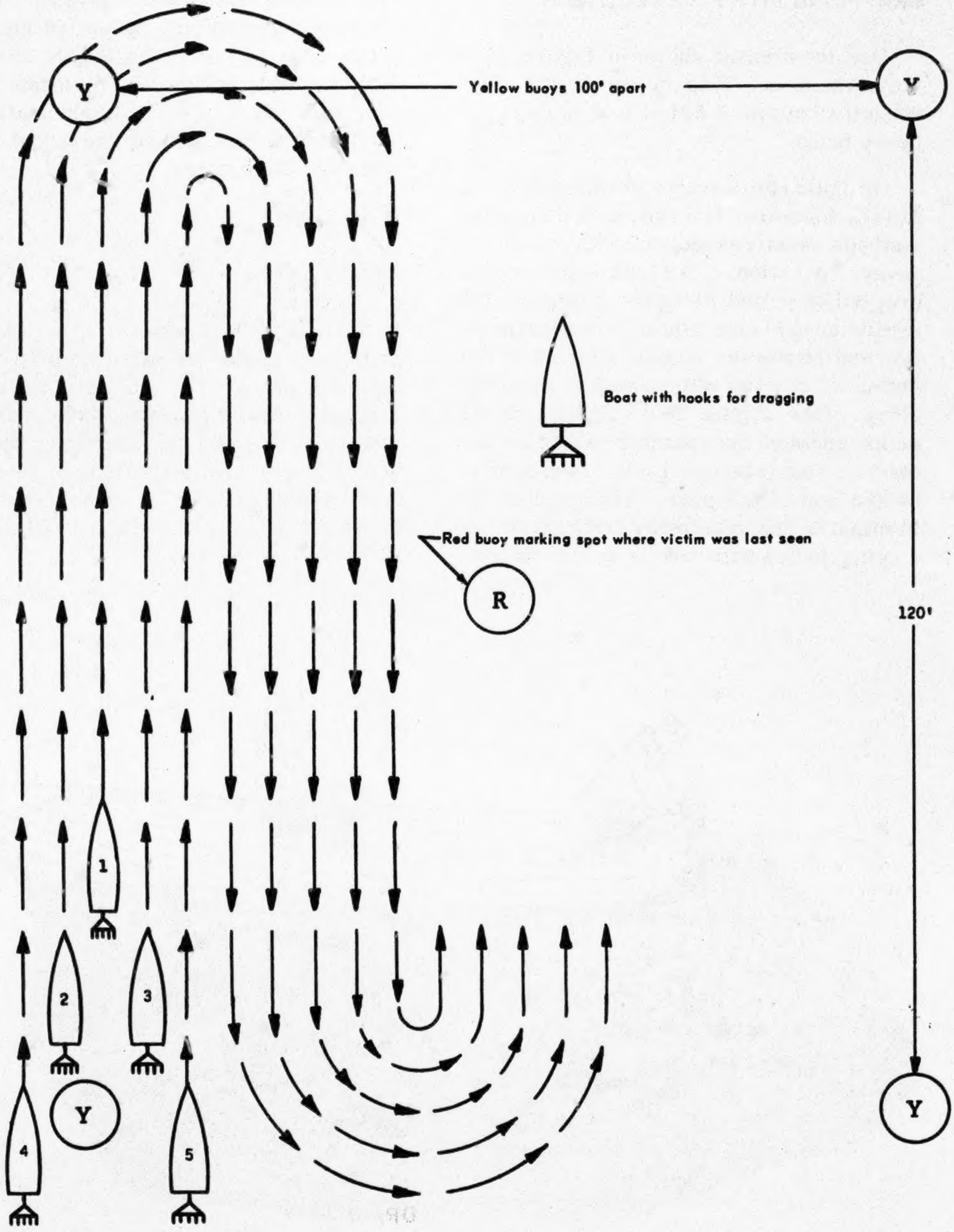

Y
Yellow buoys 100' apart
Y
Boat with hooks for dragging
Red buoy marking spot where victim was last seen
R
120'
1
2
3
Y
4
5
Y

Figure 17

Dragging operation, using more than one boat

GRAPPLING WITH PIKE POLE IRON

Use the method shown in Figure 15 to cover the area. This method is very good when the bottom is full of tree stumps and heavy brush.

Grappling for a body with pike pole irons differs somewhat from the actual dragging methods usually associated with a body recovery operation. Pike pole irons are not dragged or pulled along the bottom. The squadman holds the pole in a vertical position and tamps the bottom with quick up-and-down strokes while the boat is moved along. (See Figure 18.) This probing action enables the operator to feel or determine what is being struck, on the bottom, by the end of the pole. This action also eliminates the possibility of the iron becoming fouled with debris on the bottom. The boat must continue to move very slowly during the searching operation until the entire area has been thoroughly covered. When the body is "struck" or located, the boat must be stopped and held stationary until the body has been securely hooked and raised to the surface.

SITUATIONS

Situation #1

A boy starts to swim a large lake on a dare; about one-quarter mile offshore he tires and sinks. He is noticed by his pal who calls the life guard and lake manager. The manager calls the emergency squad at once. They arrive within four minutes and start dragging at once. (Time was not taken to set out buoys.) See Figures 20 through 24.

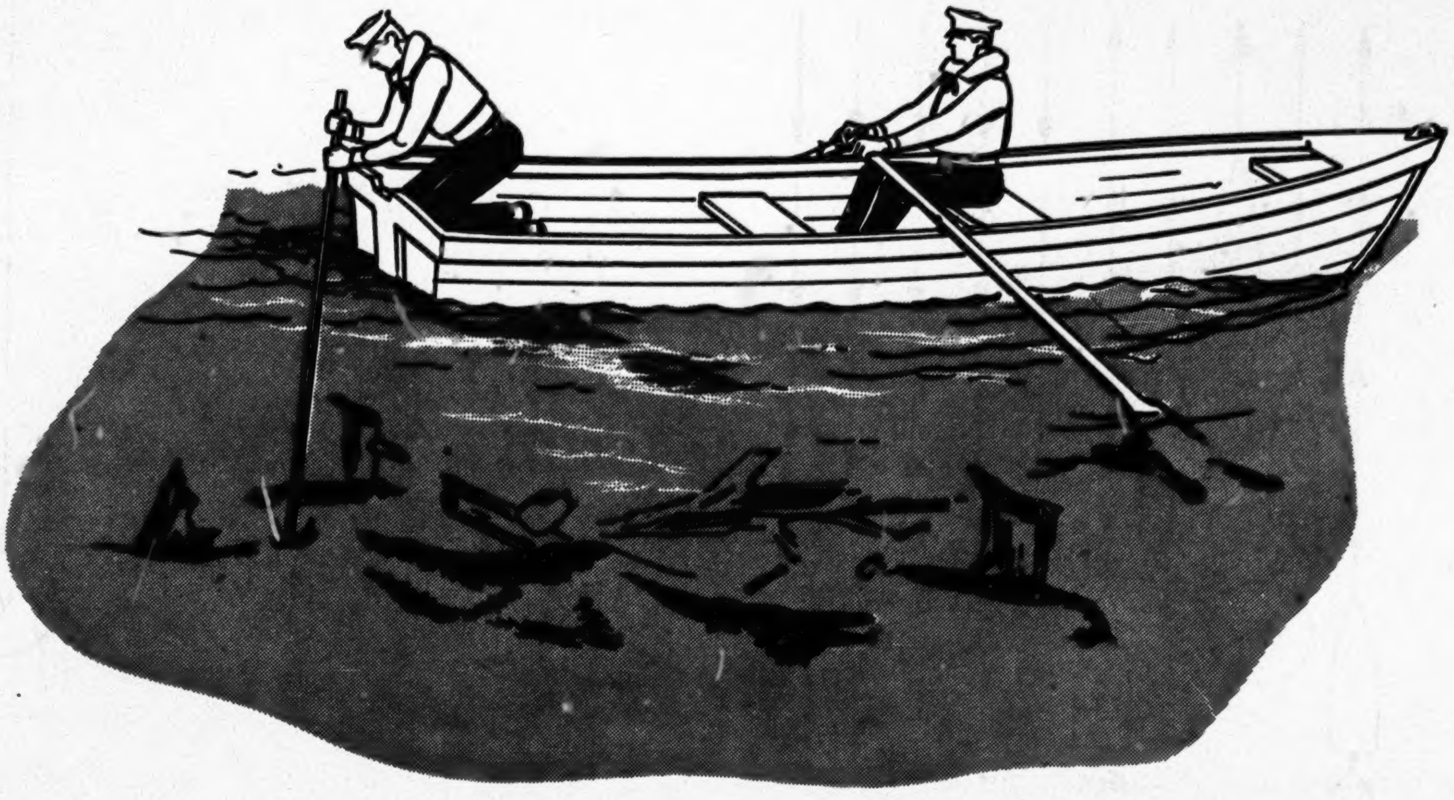
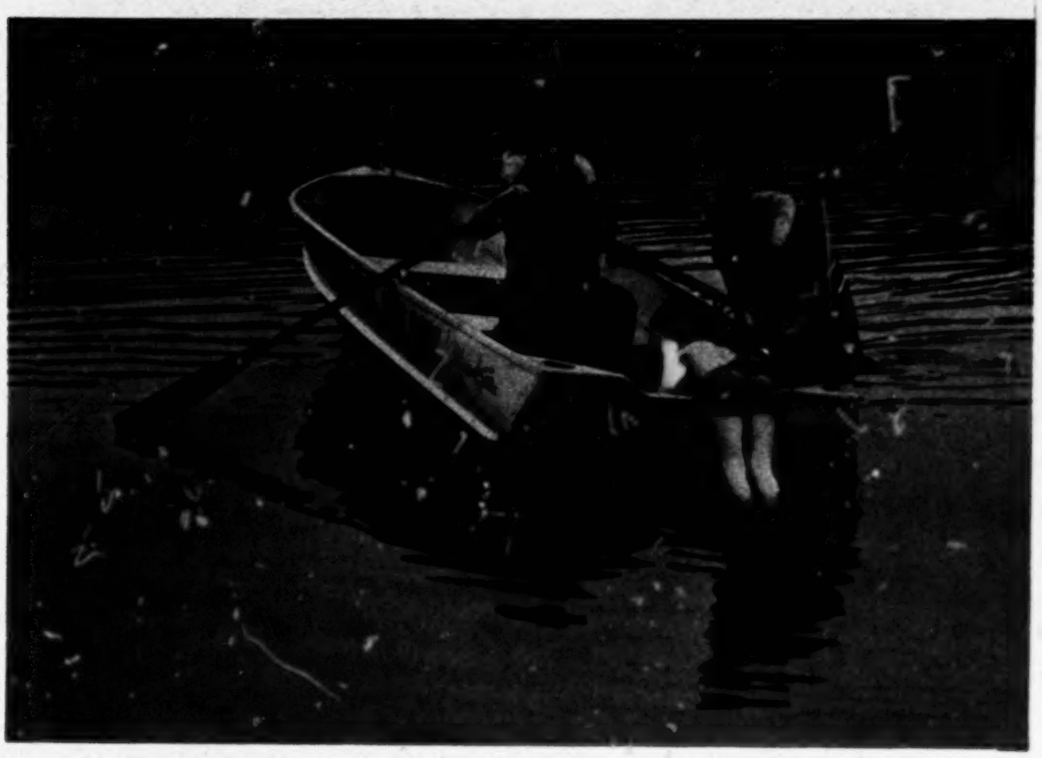


Figure 18

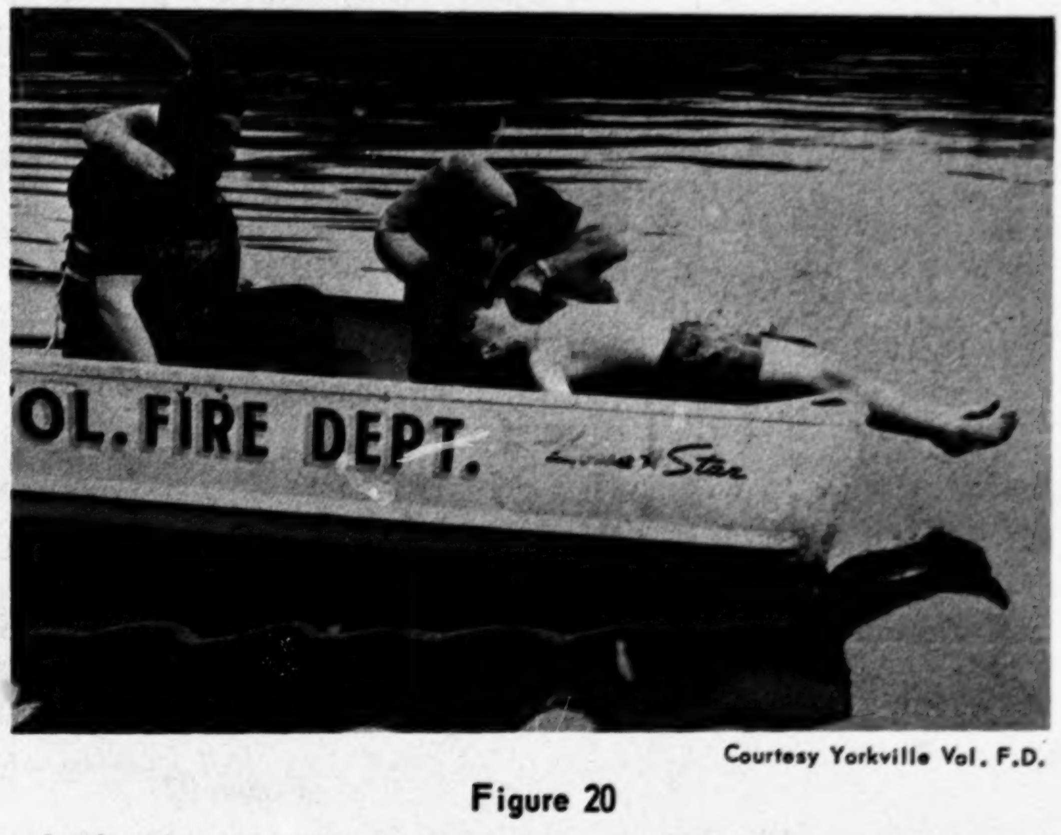
Grappling with pike pole iron



Courtesy Yorkville Vol. F.D.

Figure 19

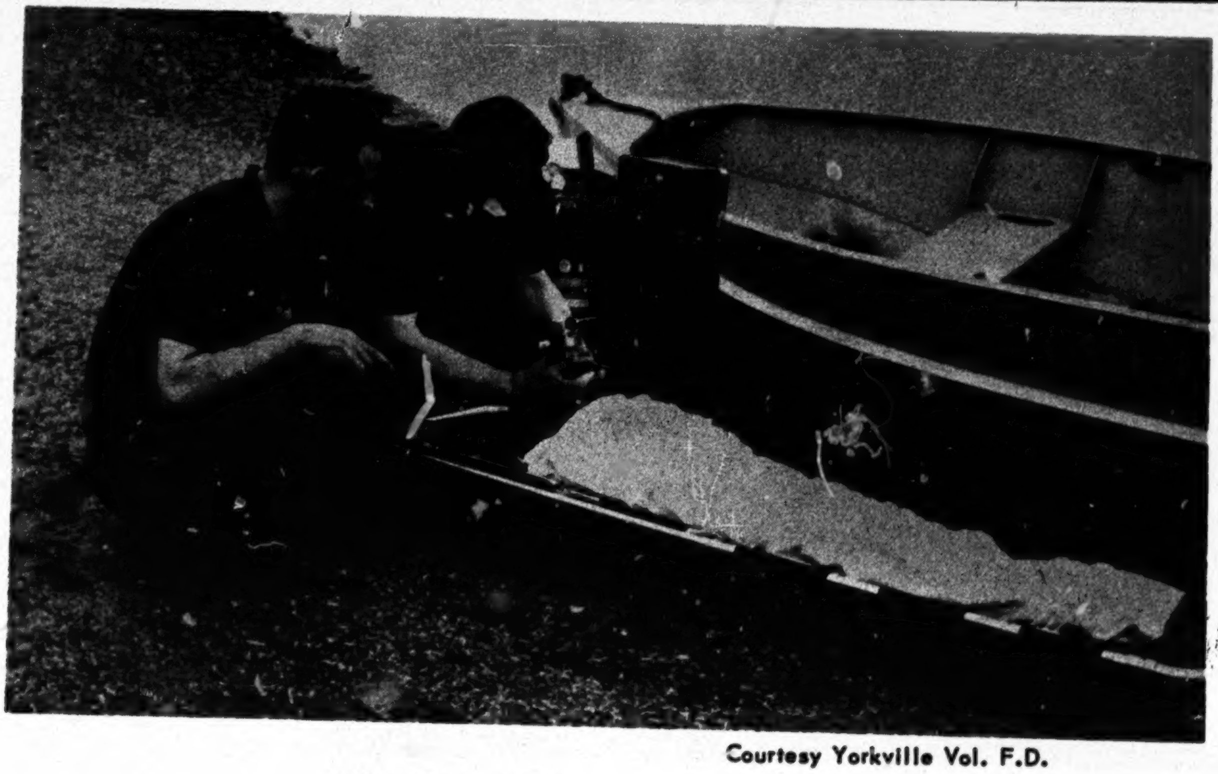
On the second pass over the area the boy's arm is hooked by the grappling equipment. The squadman gently raises the boy to the surface and lifts him over the stern into the boat.



Courtesy Yorkville Vol. F.D.

Figure 20

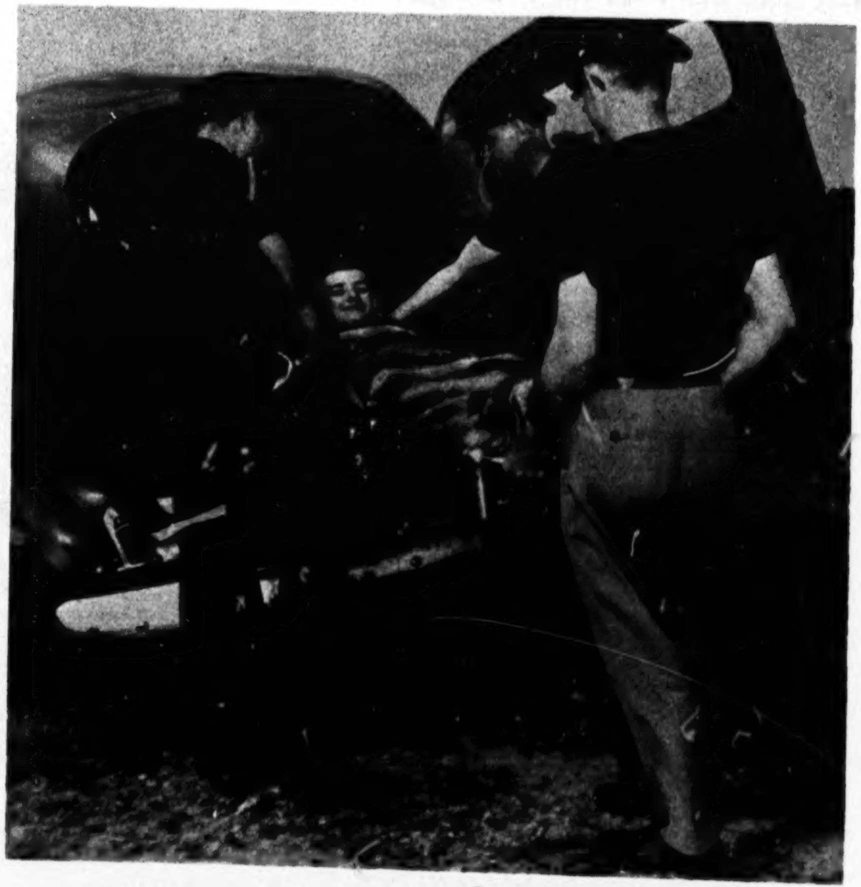
Artificial respiration is started at once. With two rescuers and the victim in the boat, rowing would be awkward. Therefore another boat, manned by a squadman and a lifeguard, will tow the rescue boat to shore.



Courtesy Yorkville Vol. F.D.

Figure 21

On shore the body is covered with a blanket and mechanical resuscitation is started.



Courtesy Loudonville Vol. F.D.

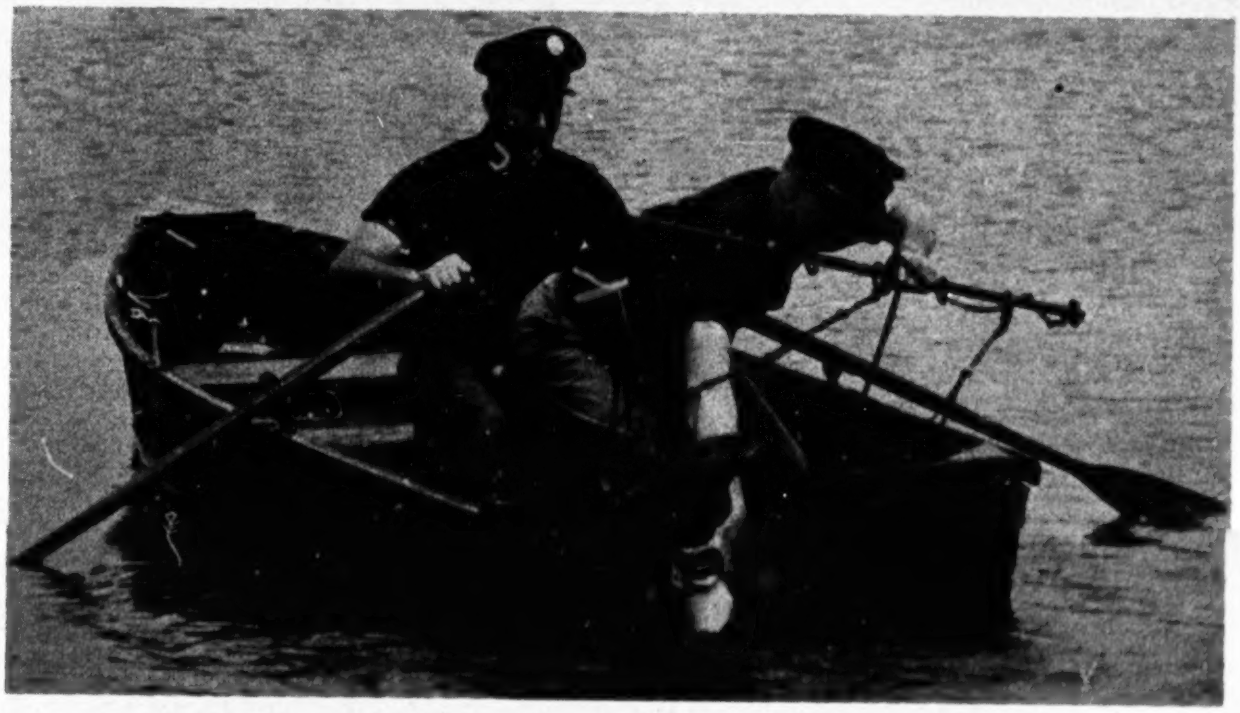
Figure 22

The boy recovers after 20 minutes. Although he feels fully recovered, squadmen load him into the ambulance for transportation to a hospital. He remains there for 24 hours under careful observation, then is released. This is the happy ending of a serious situation.

Situation #2

Fisherman rents a boat from a park manager at 11 p.m., for all-night use. When the manager arrives at the park at 7 a.m. he sees the empty boat and investigates. Evidence indicates the fisherman fell into the lake.

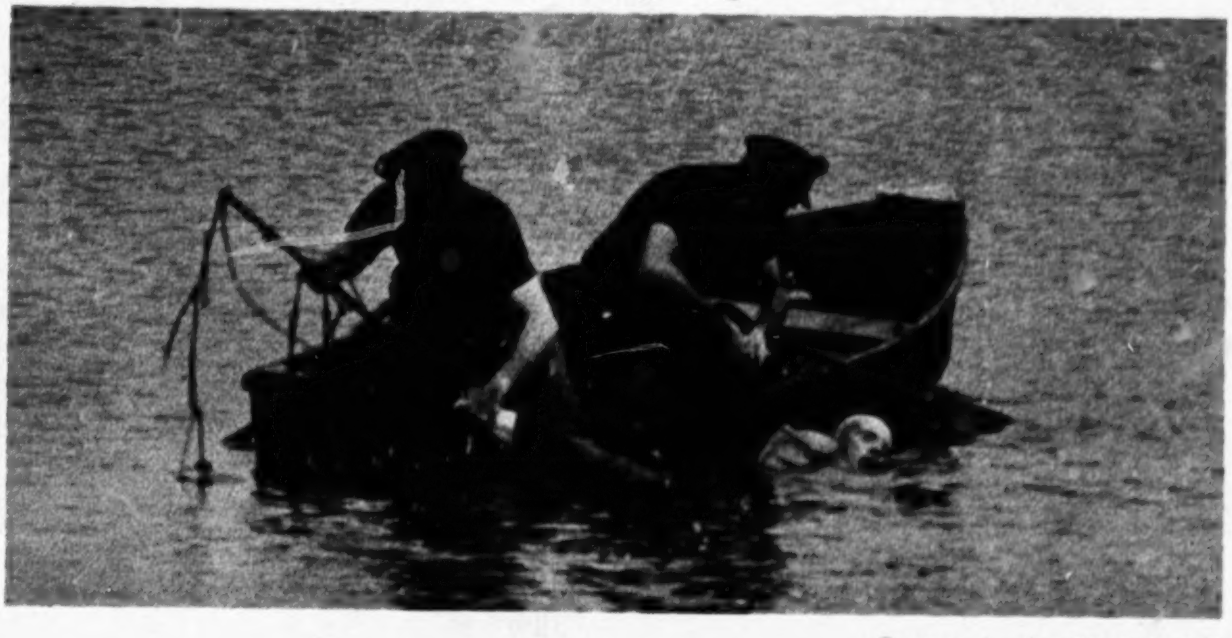
The manager calls the sheriff and the highway patrol. After one hour of consultation, they call the emergency squad and the coroner.



Courtesy Loudonville Vol. F.D.

Figure 23

As the boat is still anchored it is not necessary to place a red buoy; the boat serves as a marker. The victim's wife arrives. The squadmen start to drag at once. After twenty-five minutes of dragging, they are about to take the time to use the systematic method when the body is hooked by the right leg.

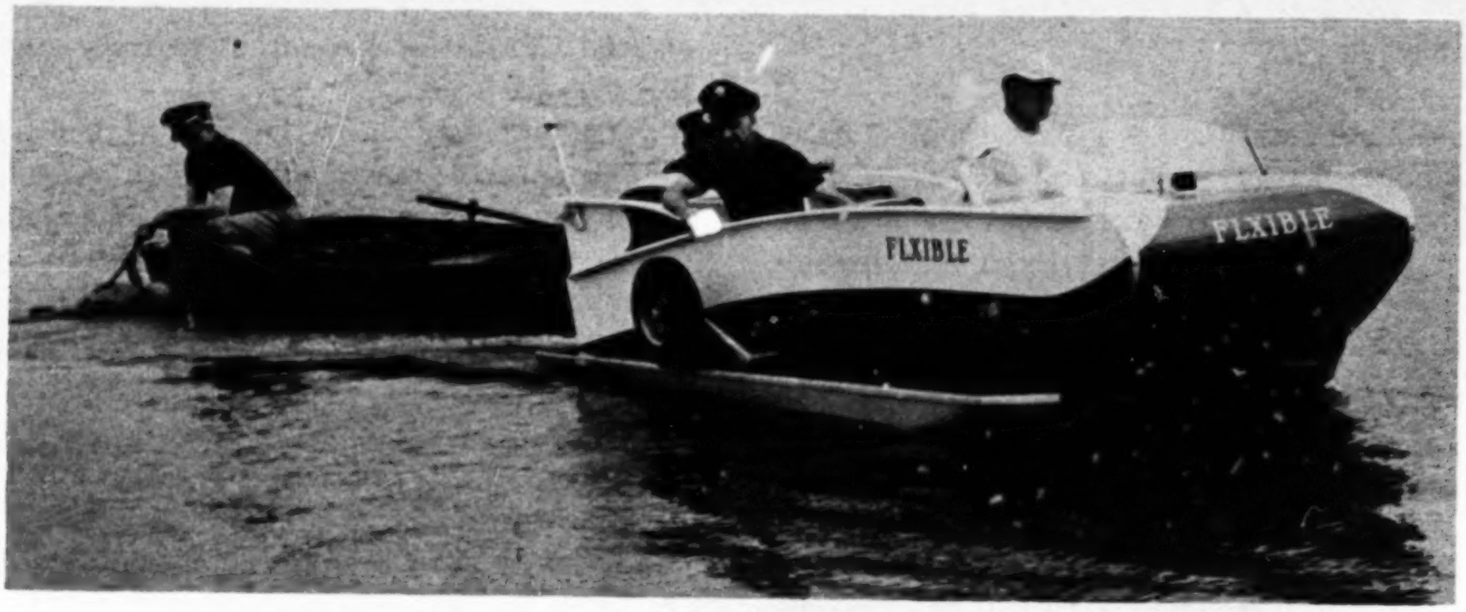


Courtesy Loudonville Vol. F.D.

Figure 24

Squadman #1 secures the body with rope under the arms, as Squadman #2 removes hooks.

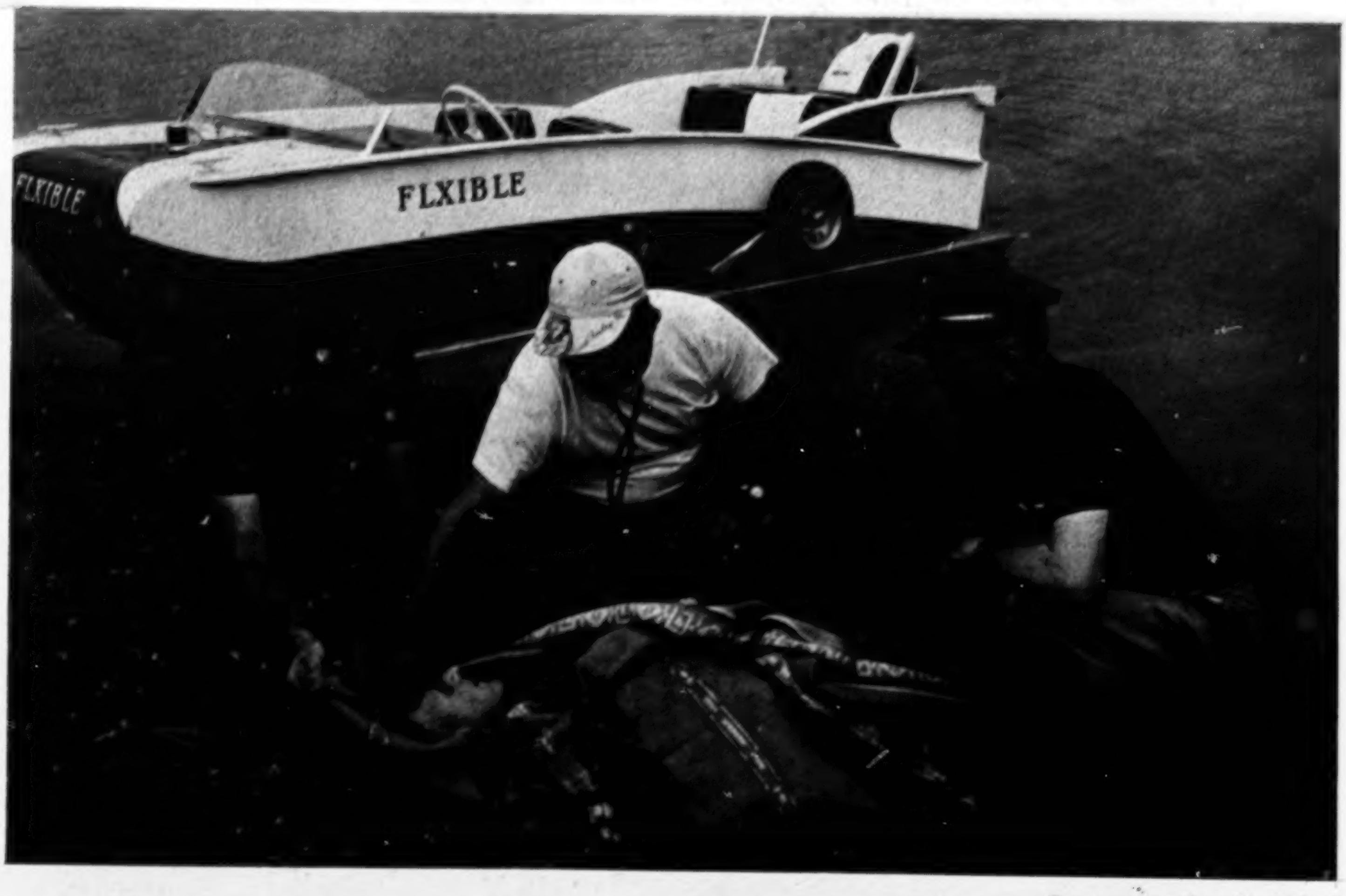
* In these posed pictures squadmen did not wear life jackets. In an actual rescue men would be wearing life jackets during the boating operation.



Courtesy Loudonville Vol. F.D.

Figure 25

As it is a long distance to the shore, the coroner in his boat tows the boat and body to shore. (Note body is not pulled into boat, but is floated to shore.)



Courtesy Loudonville Vol. F.D.

Figure 26

The body is wrapped in a blanket to conceal it from onlookers, With the assistance of squadmen, the coroner makes his examination. He takes charge of the body.

SUMMARY OF OPERATIONS AT SCENE OF DROWNINGS

Authority

An emergency squad should be in charge of the scene and operations.

Procedure

In most instances, rescue operations should be based on use of a boat and other equipment. NO ONE SHOULD ENTER THE WATER UNLESS HE IS A QUALIFIED RED CROSS WATER SAFETY MAN, SENIOR LIFE SAVER OR INSTRUCTOR. Personal entry into the water is indicated when the victim can be seen and is moving and when there is substantial evidence that the victim has been in the water for only a few minutes.

Life jackets must be worn by any non-swimmer working in a boat. In swift water EVERYONE who works in the boats must wear life jackets. Remove all equipment from the rescue boat except that needed to start operations, before launching it.

In a two-man boat, one man should row while the other uses the dragging equipment. The man who is dragging should kneel on the stern seat and use the equipment over the stern of the boat.

If recovery is made within a reasonable length of time, artificial respiration should be started immediately. The resuscitator should be put into service as soon as possible.

If at all possible, recovered bodies should be put into body wrappers while in the water.

In the event of a drowning, the coroner and the police must be notified.

SKIN DIVING

Skin diving should be limited to experts who have approved aquatic equipment.* It is recommended that the local skin diving club be contacted, and an emergency plan of operation be set up with club members so that squadmen may call for their services in an emergency. After a plan is agreed upon, the telephone numbers of the club members should be available at all times.

---

* As is taught in other areas, when a special situation arises, call in a specialist. Utility companies are frequently called in for the use of their special skills. The same policy should be followed when rescue work involves skin diving.

WATER RECOVERY PROCEDURES DURING ICE CONDITIONS

The following information is included as a guide to the rescue squad in supervising efficient recovery operations during ice conditions. The skin divers called in will do the actual recovery, but the squad may have to supply much equipment, to enable divers to work swiftly and safely.

Keep everyone off the ice until the safety factor has been ascertained.

The point of entrance of the victim into the water probably will be readily ascertainable. Any current of water movement should be noted.

Special Equipment

The following equipment should be available:

Ice chisels
Ice saws or chain saws
Crowd-control ropes, with stakes
Creepers
Pike poles
Ice tongs
Skidway for sliding chunks onto ice or shore
Power megaphones
Anchor and ring on line
Five-foot snap and ring lines for divers underwater

This equipment can be kept together at squad headquarters for use when needed.

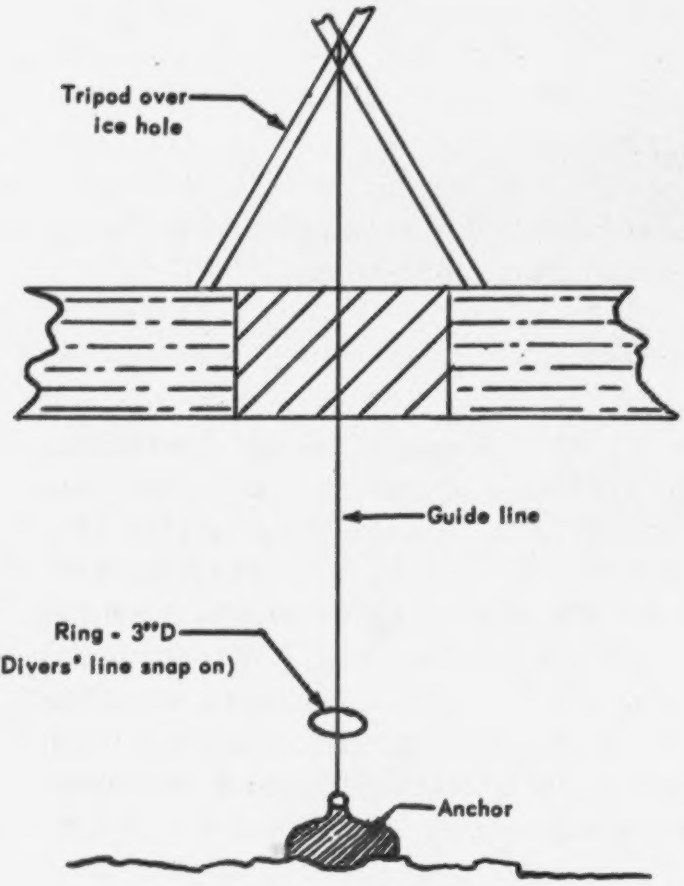


Figure 27

Guide line with ring attached, connected to tripod and anchor.

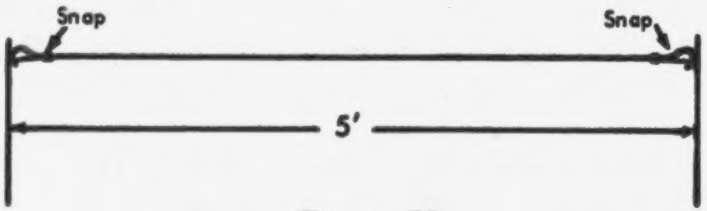


Figure 28

Five-foot snap line or distance line. Diver snaps one end of line onto ring and other end onto his gear.

Use of Divers

In a pond or lake, if divers are to be used and the ice is sufficiently thick to sustain men's weight, the chief preparation will be the opening of a four-foot-square hole at the point of entrance. Anchor line, ring and tripod should be gathered and set in place. Preparations for arrival of divers should then be started. All pertinent information (water movement, etc.) should be available to them on their arrival.

Adequate dressing facilities must be arranged. These must be warm and comparatively near to the scene.

Hot coffee and/or chocolate should be available for divers at all times, at the water area and in the dressing room. Hot chocolate is preferable to coffee in many instances, as it is a very rapid body-heat builder.

As soon as manpower permits, the diving area should be roped off so that bystanders or sightseers will not be endangered or hamper the operations of the crew.

Because of the danger involved, nighttime operations should be limited.

The resuscitator should be kept standing by, during the time men are on or near the ice or water.

A recommended pattern of search is shown in Figure 27. Note that all areas are searched twice when this pattern is followed. Divers underwater on any one hole should be limited to a maximum of three. For each of these divers there should be a tender at the surface, manning the safety line.

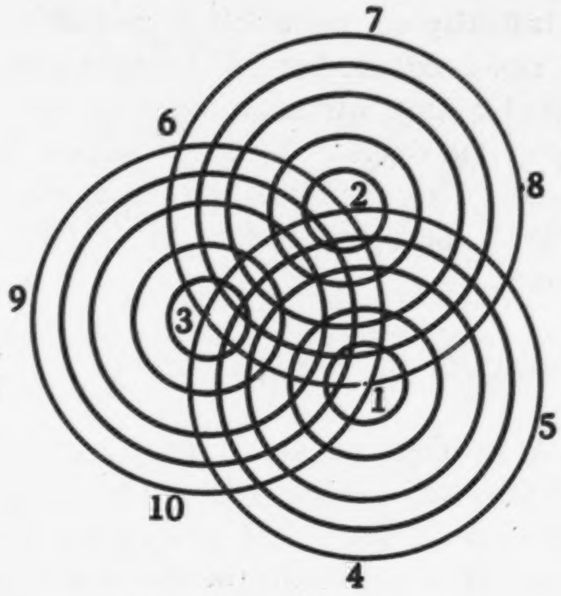


Figure 29

Pattern for under-ice search. The holes are 5 feet apart. Divers enter holes No. 1, No. 2, and No. 3 first. If the body is not recovered, additional holes for searching can be made at locations No. 4 through No. 10, and the same recovery procedures followed.

Opening Ice

If ice is less than two inches thick, it probably will be better to break a channel with the boat. The boat proceeds in the channel and the divers fan out underwater (not more than five to cover an area on both sides of the channel. There should be no problem in adequately running parallel lines on this type of operation.

Methods of opening the ice will depend on thickness. Ice between one and three inches thick may be cut with a chain saw off the side of a boat or other support. Ice thicker than three inches may be cut with a chain saw while walking on the adjacent ice. Under one inch it will be more practical to break the ice with axes or chisels.

Initially as much ice as possible should be removed from the critical area, and pulled a safe distance away by the use of ropes and tongs. This will allow working space. This could be done as much as possible by the squad before the arrival of the divers.

Operations in Flowing Current

A barrier of snow fence, goat fence, chicken wire, etc., should be placed well downstream (one-half mile) from the point of entrance. Search operations should start at this barrier and proceed back upstream toward the point of entrance.

Approximately 50 feet of the river or stream should be cleared of ice, and the bottom thoroughly searched. Be sure to search the underside of this removed ice. Than the ice upstream may be cut into small manageable chunks and floated down into the cleared area. Again the bottom should be searched as the removal of ice progresses upstream.

If sufficient searchers are available and the water depth is not too great, a solid line of men can be formed across the stream. By slow prodding and removal of ice, the entire stream should be adequately covered back toward the point of entrance.

CHAPTER XXIII

UNUSUAL SITUATIONS

INTRODUCTION

Previous chapters have explained various rescue techniques, giving in many instances examples and illustrations of their use. This chapter describes unusual situations which could not be classified with material in previous chapters. In each example a problem is presented and appropriate procedures are suggested.

It is not practical to attempt to show or discuss in this manual every possible type of accident, or the unlimited number of circumstances which might surround an accident. However, from examples shown, squadmen should foresee many of the situations in which they may find themselves. In this way the necessary plans can be made not only within their squad, but with cooperating agencies and individuals, to meet situations which may arise.

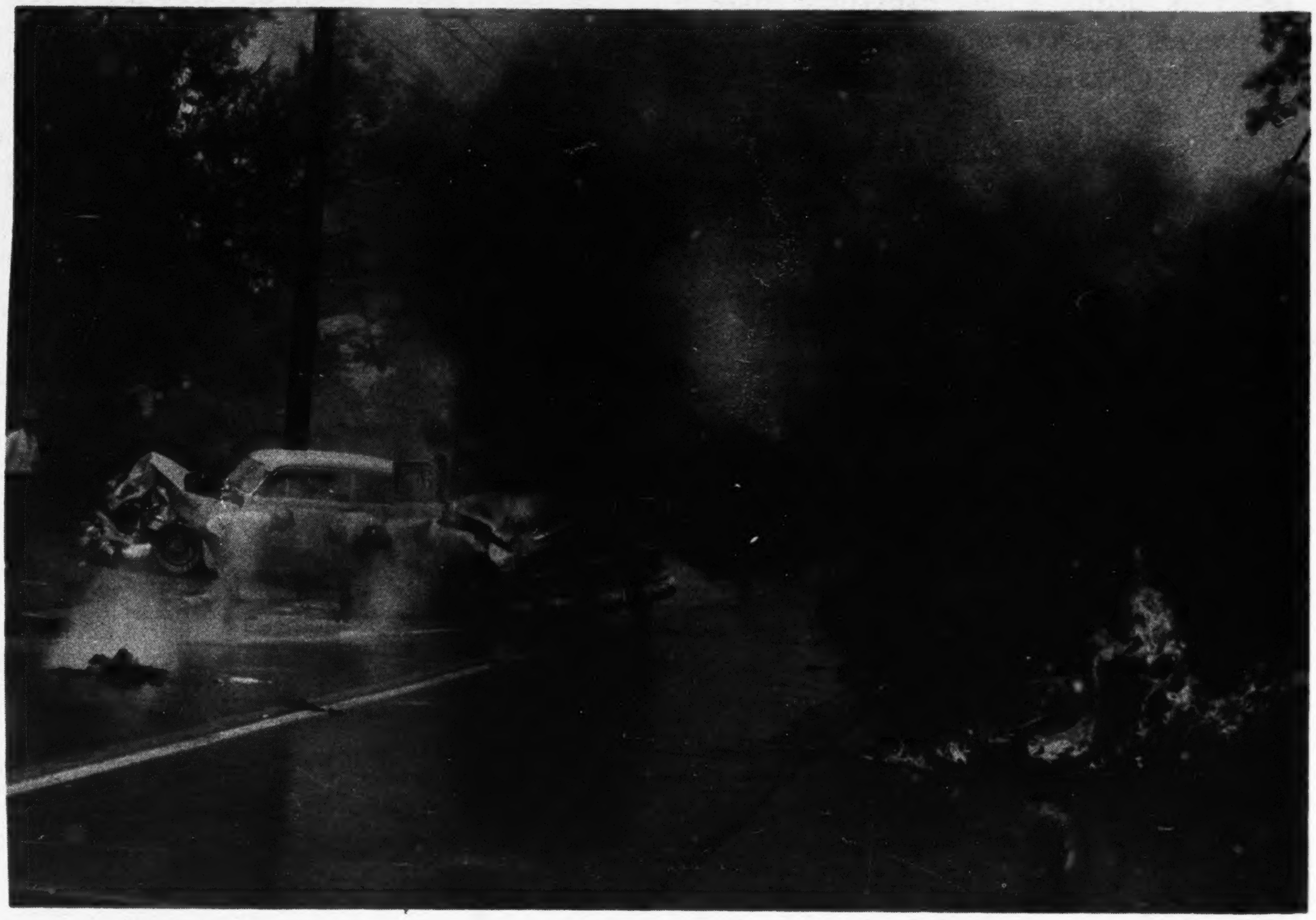
HIGHWAY ACCIDENTS

Figure 1 shows a truck and automobile which collided on a very busy highway. Before the emergency squad arrived, some motorists removed the injured truck driver from his truck and placed him on the ground near his vehicle. Gasoline leaked from the damaged tank of the truck, contaminating the immediate area. Just before the emergency squad arrived a "non-thinking" bystander lit a cigarette and carelessly tossed his match to the ground.

The area was immediately engulfed in flames. The victim died of severe burns. It was later found that he had suffered only fractured wrists in the accident.

There are several lessons to be learned from this unfortunate event. The following precautions should have been taken:

1. The victim should have been removed a safe distance from the spilled gasoline.
2. A fire department should have been called to eliminate the hazard caused by spilled gasoline.
3. Bystanders should have been kept back from the contaminated area.



Courtesy Northern Hills F.D.

Figure 1

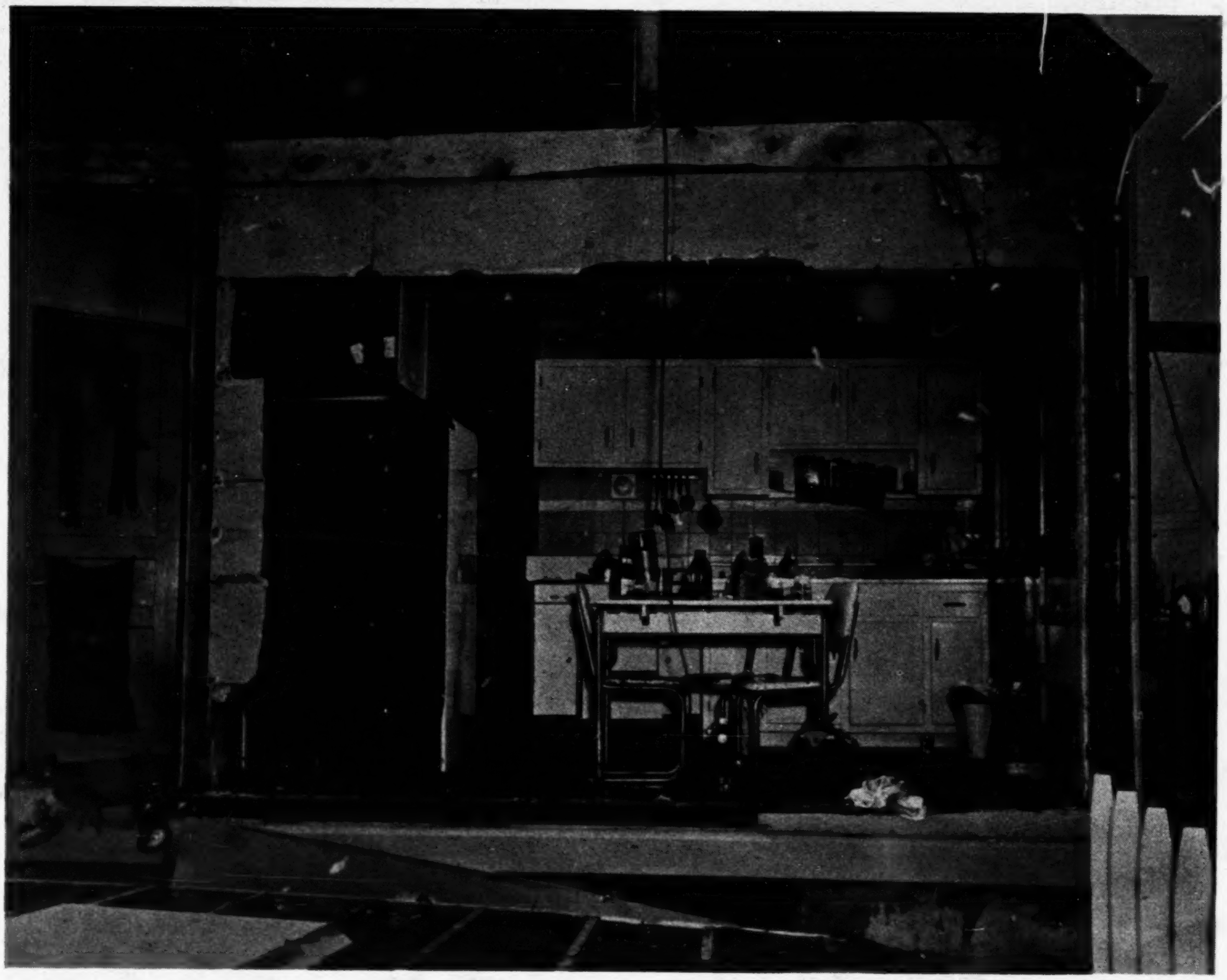
Highway accident

HOME EXPLOSIONS

Figure 2 shows a home which has been ripped by an explosion. Squadmen on arrival must take the following action.

1. Give first aid to victims with burns, cuts, and puncture wounds.
2. Give care for shock and hysteria.
3. Transport victims who need medical attention.
4. Check neighboring homes for persons who may also have been injured.
5. Notify law enforcement agencies so that property will be protected from vandals and so that help will be available to control possible crowds.
6. See that utilities are cut off, and that utility companies are notified.

If a fire department responds to the call, firemen may assume responsibility for Items 5 and 6, and may assist squadmen in Item 4.



Courtesy Mifflin Twp. F.D.

Figure 2

Home explosion

STORE BUILDING EXPLOSIONS

In a public building or store explosion the problems will be quite different from those resulting from a home explosion, for the following reasons:

1. The building will be larger and usually will be located near other large buildings. Since the debris will be confined by other buildings, it will fall back, covering victims who are in or near the building at the time of the explosion.
2. The number of victims probably will be greater.
3. The problem caused by spectators will be more difficult, due to the greater number of them and the crowded surroundings.
4. When utility services to the building are cut, large numbers of people in the area will be affected.
5. To cope with a disaster of this type, preplanning is essential. Heavy-duty equipment will be needed to remove debris, so that trapped victims can be rescued. It may be desirable to call neighboring squads, and local and neighboring ambulance services.

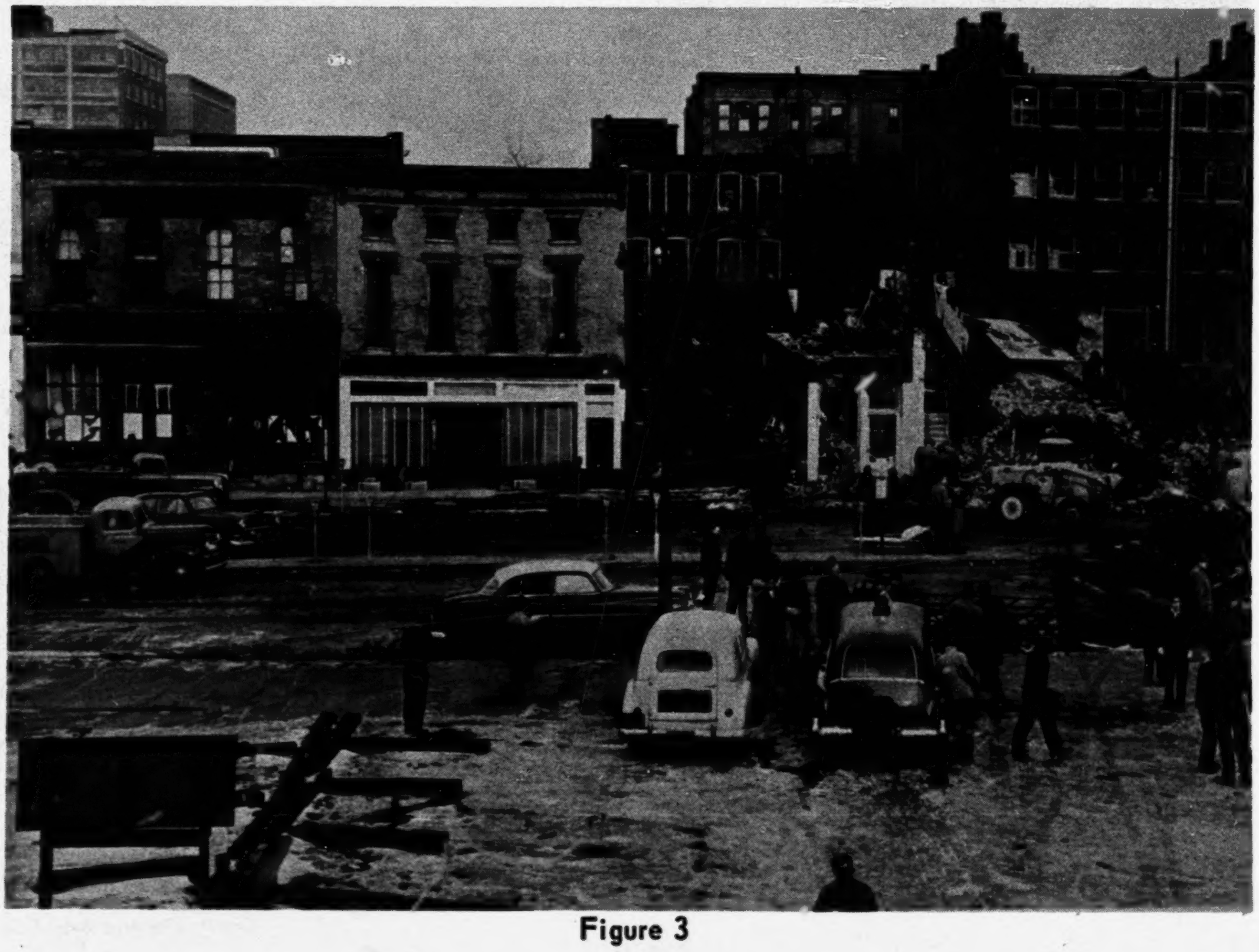


Figure 3

Store building explosion

In Figure 3 note the following:

1. A fire truck and charged hose line are on location to extinguish smoldering embers when they are encountered.
2. Emergency squads are standing by to transport the injured.
3. A high-lift loader is available to help in moving debris.
4. A truck and personnel from a utility company are on the scene.

SPECIAL EQUIPMENT

Figure 4 shows a large clam shovel being operated by a construction company. Preplanning made it possible to acquire the services of this piece of equipment rapidly.

In Figure 5, a bulldozer has been put into service. In the foreground, firemen are removing the cable from the shovel so that the hook may be used to remove a steel beam.

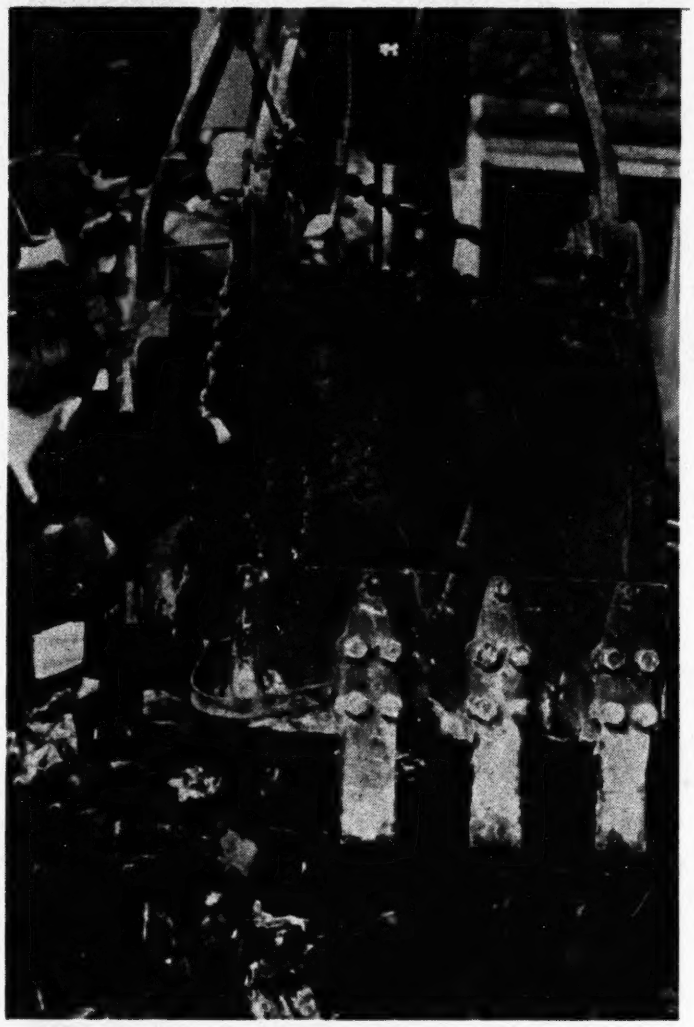


Figure 4

Clam shovel

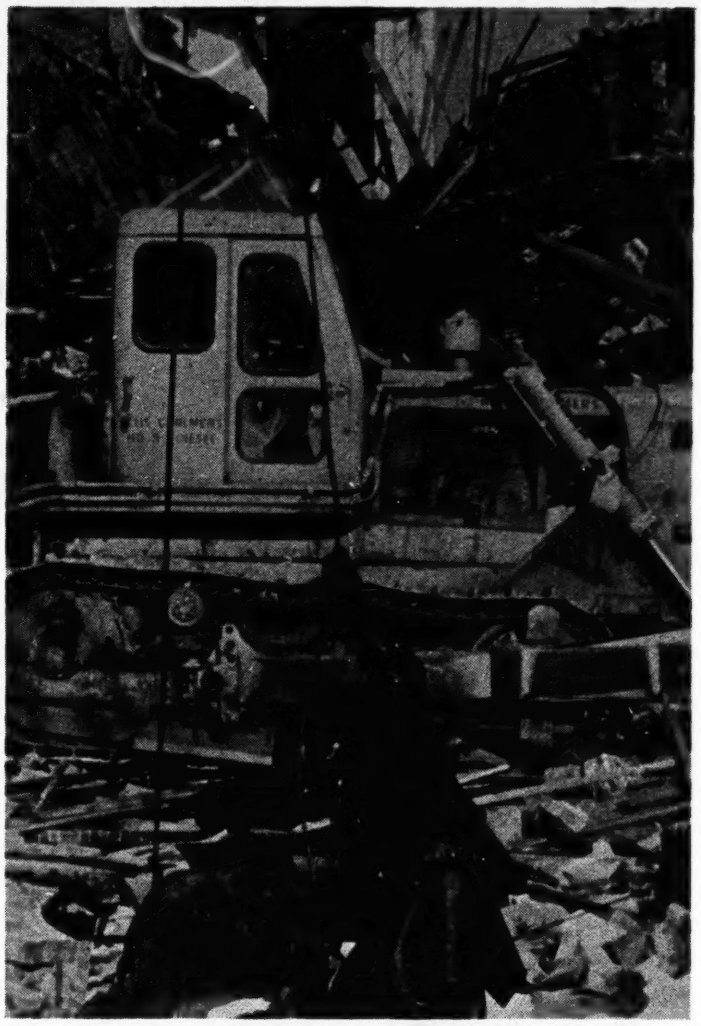


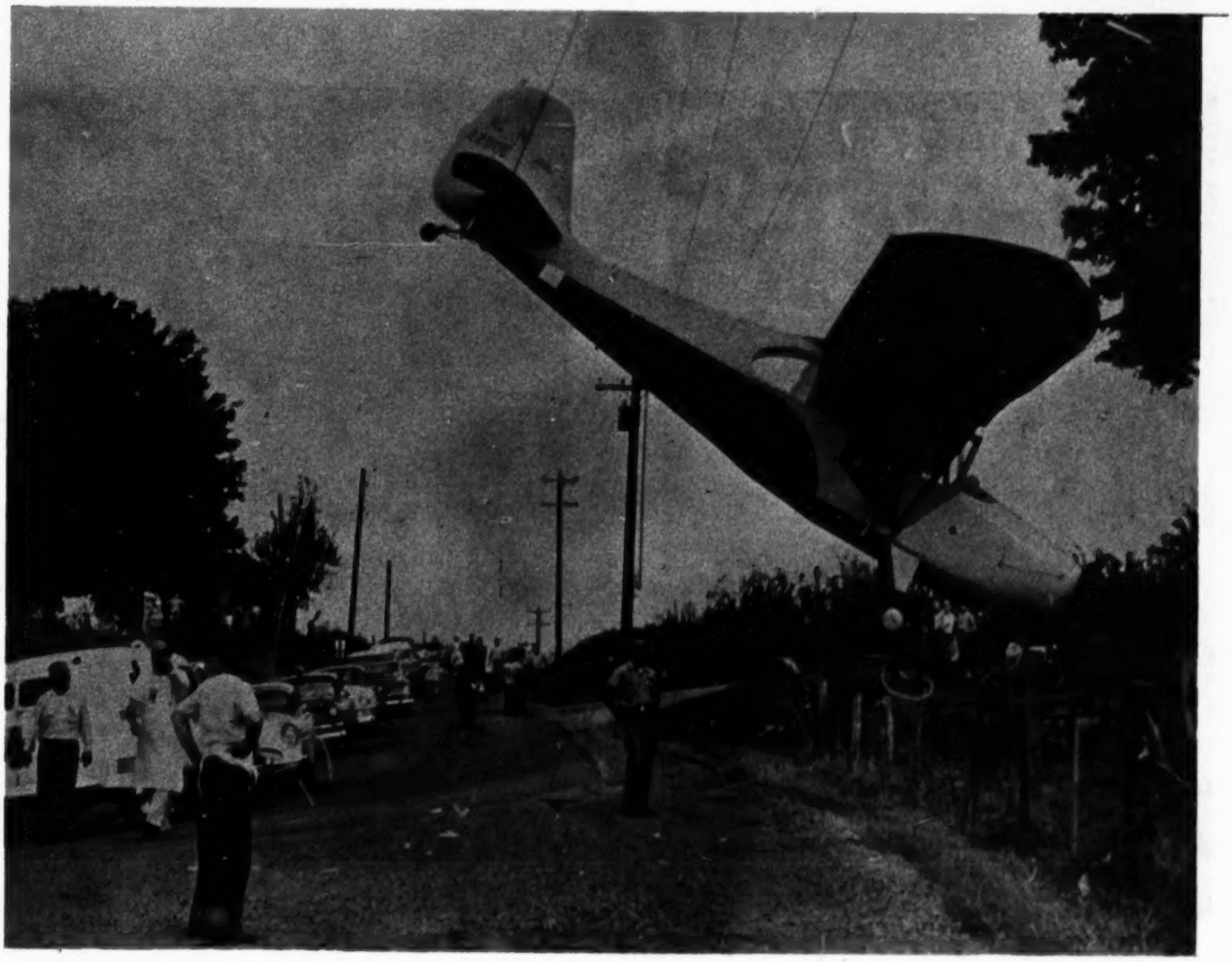
Figure 5

Bulldozer

AIRPLANE ACCIDENTS

Figure 6 shows another unusual situation. Squadmen acted wisely by taking the following action:

1. Passengers and pilot were told to remain in plane. Victims and rescuers might have been electrocuted if a rescue was attempted without having power disconnected.
2. The power company was contacted, to have electric lines de-energized. Due to pre-planning, the company responded rapidly.
3. Occupants of the plane were then rescued by use of a short ladder carried on the rescue squad vehicle.
4. Even though no injuries were apparent, victims were treated for shock.
5. Victims were then transported to the hospital.



Courtesy Ohio State Highway Patrol

Figure 6

Airplane accident

It appears that not all proper precautions were taken, since cars and pedestrians were allowed to move into the danger area caused by the electric lines. The lines could break or be burned down at any moment, turning the situation into a major disaster.

NOTIFYING AUTHORITIES

In Ohio the law requires the squad dispatcher to notify the Ohio State Highway Patrol of all airplane accidents, regardless of the size of the plane.

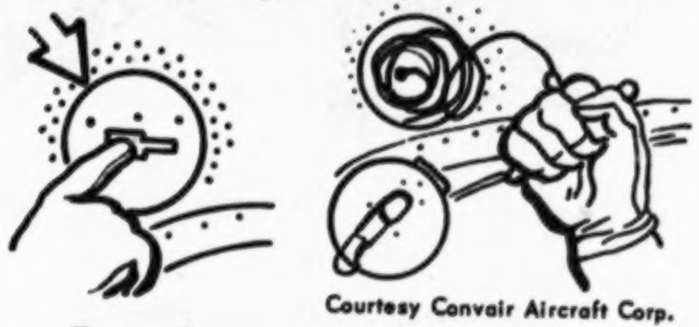
JET COCKPIT ENTRY PROCEDURES

All emergency squadmen should know what to do when confronted with the task of rescuing an injured pilot from a jet plane that is down. Squadmen who have not been trained to extract pilots properly have been killed because of their improper approach to a downed jet plane.

CANOPY EJECTION

WARNING: When fumes are present do not use the canopy ejection mechanism.

1. Remove access door on left side of fuselage, just forward of wing leading edge. Press with thumb or finger on center of circular door to open. (See Figure 7A.)
2. Reach inside, grasp exposed lanyard handle, and extend about six feet, and jerk. (See Figure 7B.)

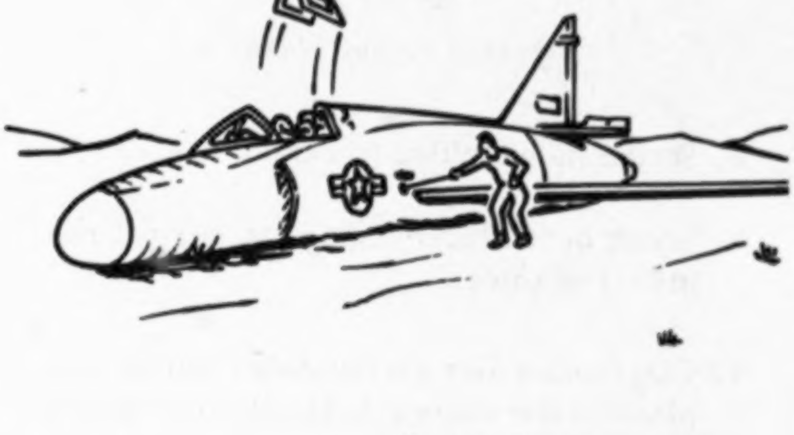


Courtesy Convair Aircraft Corp.

Figure 7a Figure 7b

Opening access door and ejecting canopy

3. Watch path of canopy during ejection to avoid being hit. Canopy will normally fall adjacent to tail section. (Figure 8.)



Courtesy Convair Aircraft Corp.

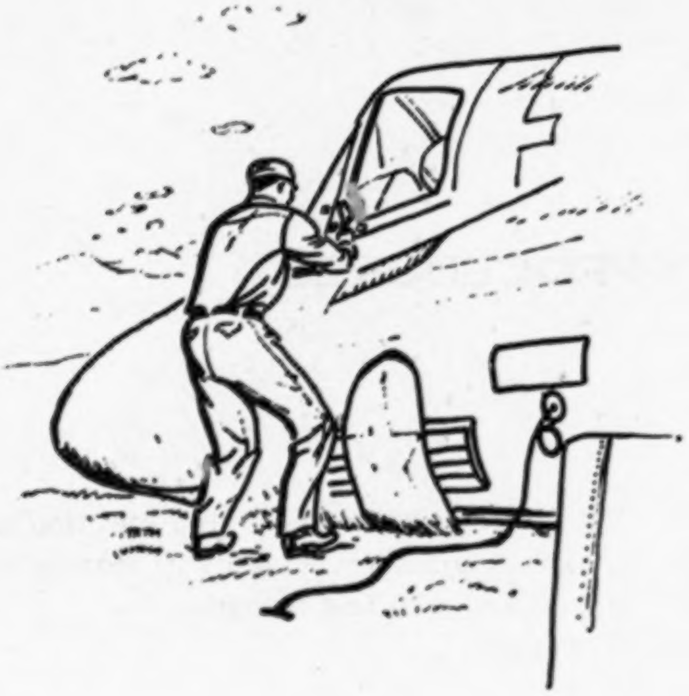
Figure 8

When lanyard is jerked, canopy usually ejects toward tail of plane.

4. Caution all rescue personnel to avoid area around tail section during canopy ejection.

Canopy Break-In - If canopy does not eject, proceed as follows:

1. Break canopy glass in lower forward corner on either side of the airplane. Use heavy (approximately eight-pound) maul. (See Figure 9 .)



Courtesy Convair Aircraft Corp.

Figure 9

Breaking canopy glass

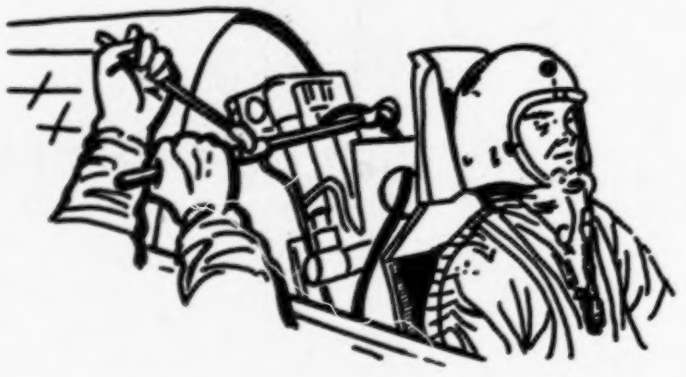
2. Strike blows close to canopy frame.

3. Break out sufficient glass to permit removal of pilot.

4. CO_2 from a fire extinguisher can be applied to the canopy to facilitate a faster entry. This causes the material to break more easily.

PILOT RELEASE PROCEDURE

Seat Ejection Mechanism - Disarm ejection seat by cutting tube behind pilot's head. Cut all tubes to the rear of the pilot's head. Some trainers and newer aircraft have more than one tube. (Figure 10.)

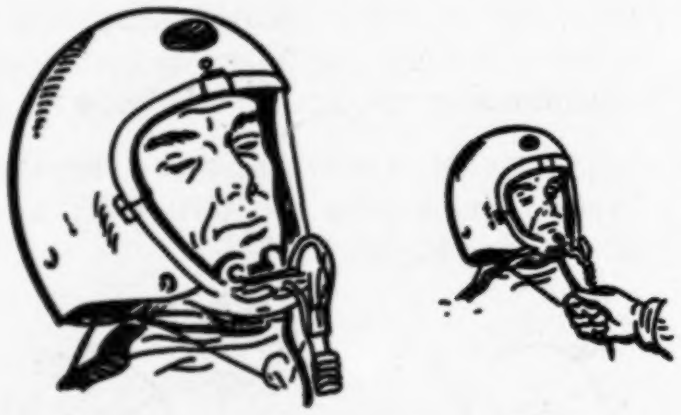


Courtesy Convair Aircraft Corp.

Figure 10

Disarming seat ejector mechanism

Helmet Face Plate - Remove pilot's face plate by pulling downward on green cord beneath his chin and lifting face plate free. This must be done before detaching the oxygen supply hose. (Figure 11.)

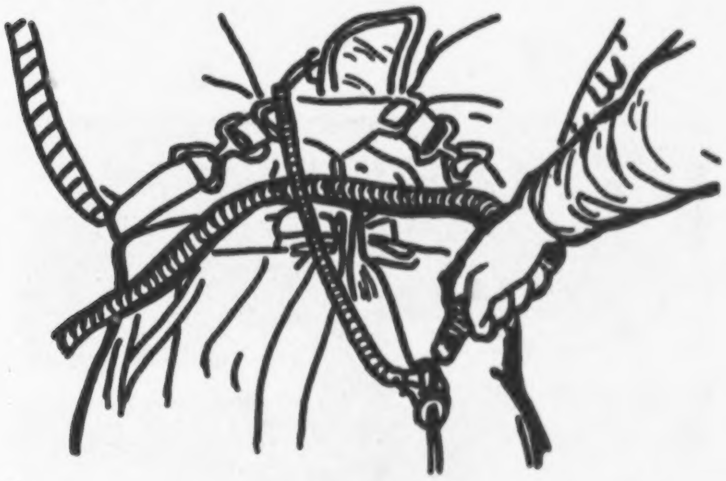


Courtesy Convair Aircraft Corp.

Figure 11

Removing pilot's face plate

Oxygen Supply Hose - Detach or cut oxygen hose which is attached to pilot's suit. (Figure 12.)

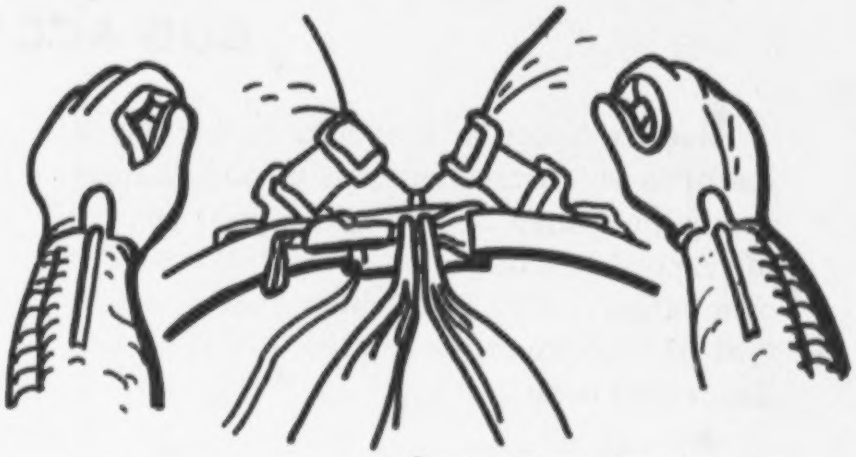


Courtesy Convair Aircraft Corp.

Figure 12

Cutting oxygen supply hose

Seat Belt and Shoulder Harness - Release pilot's seat belt and shoulder harness by unlocking buckle at pilot's waist. (Figure 13.)



Courtesy Convair Aircraft Corp.

Figure 13

Releasing seat belt and shoulder harness

Removing Victim - The victim should be lifted out by the shoulders. The squadmen should stand on the plane just behind the pilot to lift him out.

PREPLANNING FOR AIRPLANE ACCIDENTS

Because many commercial, military, and private planes are continually in the air, all squads should have a well defined plan to execute in case of aircraft accidents.

The latest military transport plane is believed to be able to carry 700 to 800 personnel on board. Does your squad have pre-plans to meet such an accident?

BUS ACCIDENTS

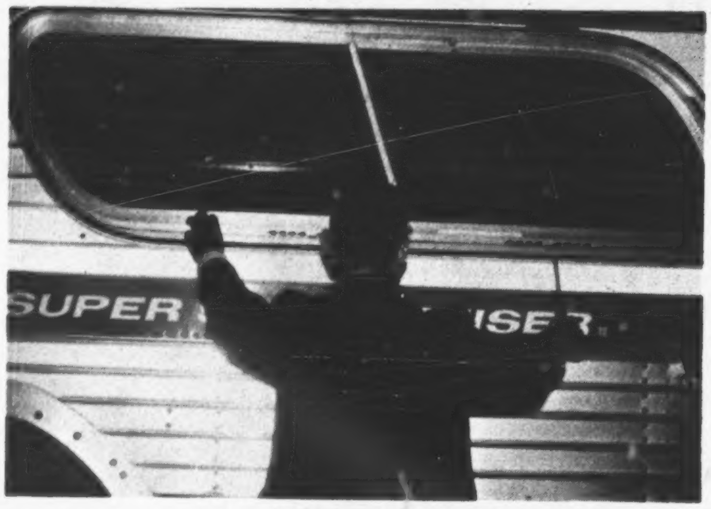
Modern buses have special construction features which must be understood by emergency squadmen for the successful rescue of trapped bus occupants, as well as their own safety. Critical design features of a typical modern cross-continental bus* are described here.

RESCUING PASSENGERS

This bus is 10 feet, 11½ inches high and 40 feet long. The coach weighs 30,000 pounds empty and 40,000 pounds loaded. Forty-three passengers can be seated in the coach: thirty-three on the upper deck and ten on the lower level.

There is no emergency door. In case of an accident damaging the entrance door, rescue must be effected through the windows or the skylights. The windows are marked on the inside by a metal plate and the skylights by decals.

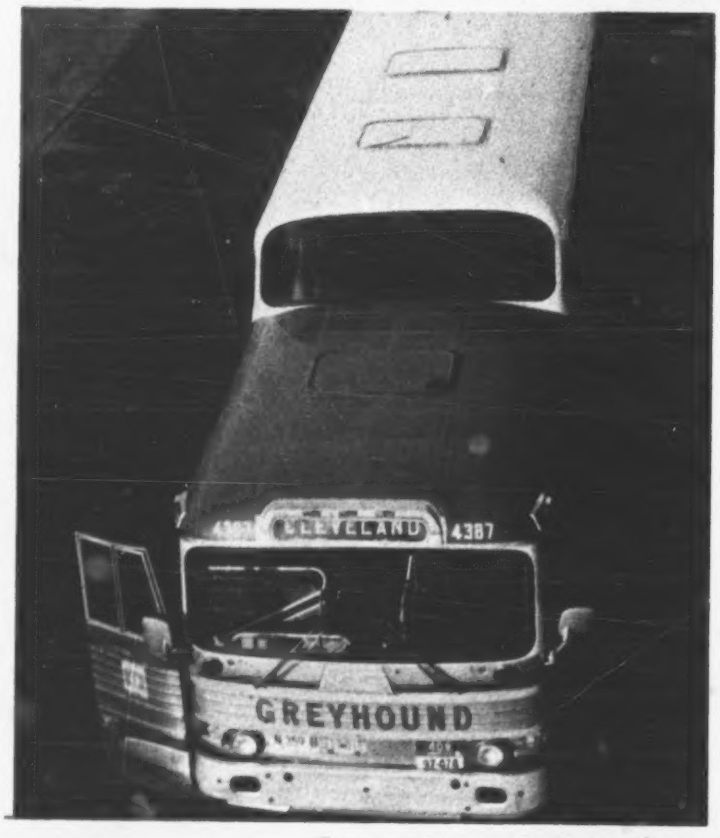
The windows are held in place by a metal frame, and are hinged at the top. To open a window from the outside, place a large screwdriver or pinch bar at the bottom of the metal frame and force the window out. To open the front windshield and skylights, take out the rubber locking strip which runs around the windshield and the skylights. The windshield, frame, and glass will all come out, leaving a smooth opening for the removal of any injured passengers. (See Figures 14 and 15)



Courtesy Eastern Greyhound Lines

Figure 14

To remove a window, pry out the locking strip.



Courtesy Eastern Greyhound Lines

Figure 15

The skylights can be removed without breaking them.

---

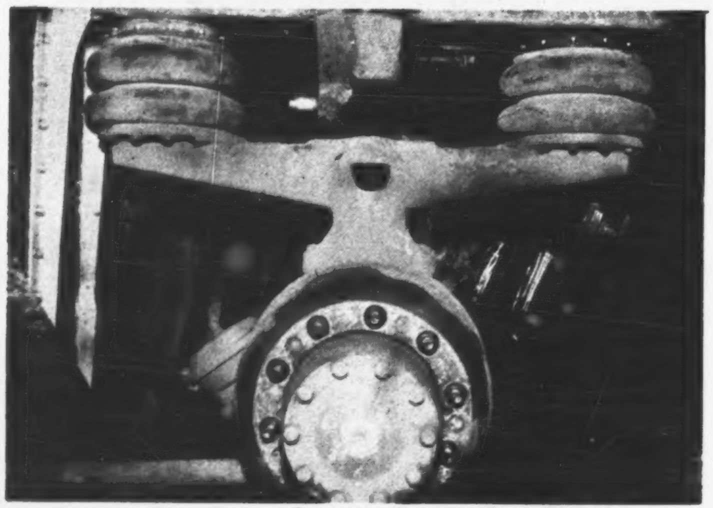
* This is a description of the Greyhound Scenicruiser, adapted from information supplied by Eastern Greyhound Lines.

This coach is equipped with a rest room located on the lower level next to the steps on the driver's side. In case of an emergency in the rest room, it may be entered from the outside by opening the large window on the driver's side. It will be necessary to prop or hold the window open, as it is hinged from the top.

BLOCKING THE COACH BODY

In case of a fire or an accident, NO PERSONNEL SHOULD BE ALLOWED TO GO UNDER THE COACH OR TO PUT THEIR HEAD OR SHOULDERS UNDER THE WHEEL HOUSING WITHOUT FIRST BLOCKING THE BUS BODY SECURELY.

The coach uses an air-suspension system for flotation, rather then metal springs. This air-suspension system consists of rubberized nylon bellows at each wheel. (See Figure 16) The bellows use from forty to fifty pounds of air, depending on the load on the coach and the road conditions; they are inflated through air chambers from the compressor. The coach is kept on an even keel by the use of leveling valves.



Courtesy Eastern Greyhound Lines

Figure 16

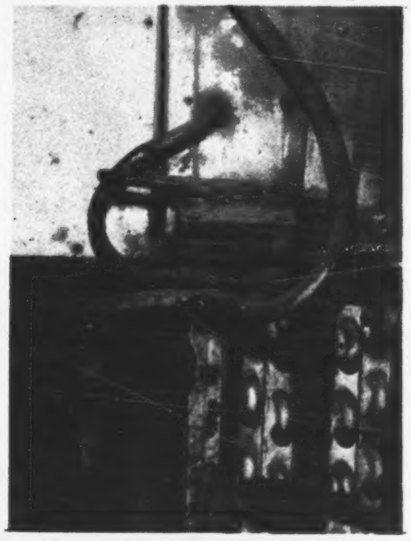
Nylon bellows support the weight of the coach body.

When a bellow is damaged, a coach can drop without warning to within three to three and one-half inches of the ground. Therefore the body must be blocked before anyone goes underneath, or puts his head or shoulders under a wheel housing.

This coach has no frame; it is equipped with jack plates located under the body behind the rear wheels. If it is necessary to jack or block under the body of the coach, jack under a solid bulkhead. These bulkheads are located in front and rear of the wheels, You may also jack under the short engine supports. Always place a support under the body before jacking, because these bodies are made of aluminum, which will tear easily.

DISCONNECTING BATTERIES

The individual circuits of the electrical system are protected by circuit breakers. However, if it is necessary to disconnect the batteries from the electrical system, push up on the battery-disconnect switch handle which is located at the rear of the battery compartment. Access to the switch is through the center engine door. (See Figure 17) To connect batteries, lower the switch handle to a horizontal position.



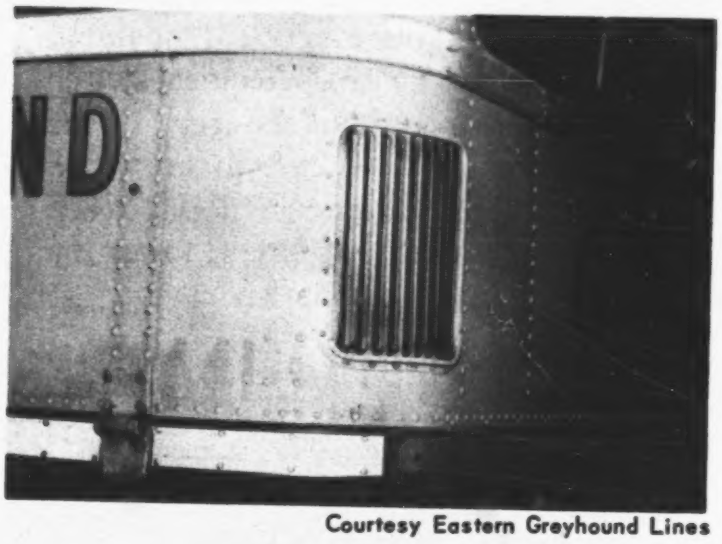
Courtesy Eastern Greyhound Lines

Figure 17

This switch will disconnect the batteries.

ENGINE AND FUEL

This coach is equipped with an eight-cylinder diesel engine which does not need electrical current to keep it running after it is started. In case of an accident, if fire department or rescue personnel arrive on the scene and find the engine running, it can be shut off with an emergency stop button located on driver's left switch panel. If for any reason the engine does not stop when the button is pushed, it may be stopped by discharging CO_2 into the air intake located at the right rear corner of the coach. (See Figure 18) This method should be used ONLY after all other procedures have failed. It is important that ONLY CO_2 be used, as other extinguishing agents may damage the engine and may cause injury to personnel.



Courtesy Eastern Greyhound Lines

Figure 18.

Discharging carbon dioxide into this air intake will stop an engine that cannot be shut off manually.

IT IS VERY IMPORTANT TO BE CAREFUL when opening the rear engine compartment doors. There are no safety guards around the fans, and speed of rotation makes them difficult to see.

The fuel tank holds 180 gallons of diesel fuel. The tank is located back of the front wheels, running across the coach. The filler cap is located on the right side. The tank has no shut-off controls. There is no gasoline carried on the coach.

EXTINGUISHING FIRES

The most vulnerable places for fires to start in this coach are the brakes on the trailing axle, the transmission, and the engine compartment. In extinguishing a fire around the transmission, attack the fire over the rear wheels on either side with fog. Make sure that fire or rescue personnel do not place their head or shoulders between the wheels and the body of the coach. An applicator is desirable.

This coach is equipped with two fire extinguishers. The Dugas extinguisher is mounted behind the glass door to the right of the operator's seat. The other fire extinguisher is located in the heater compartment. It is a liquid type, intended for use with tire fires.

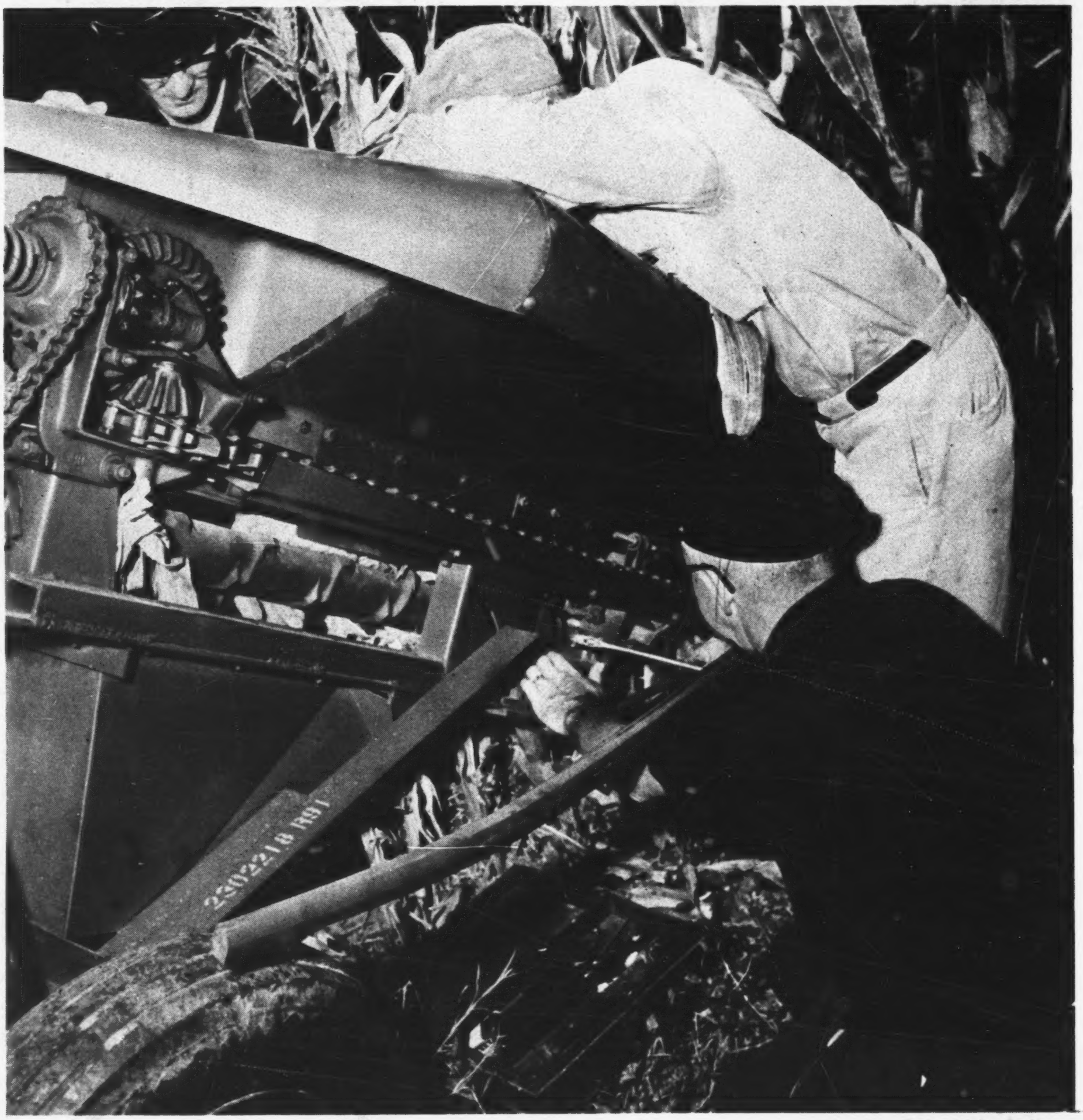
Safety flares and flags are carried in a tube at the left of the operator. A fire axe is mounted inside the dash compartment. A first-aid kit is mounted in front of the operator, above the left windshield.

AIR-SUSPENSION SYSTEMS IN OTHER VEHICLES

Air-suspension systems of flotation are being used now on many inter-city buses, city-type buses, trucks, trailers, and on one type of train. Air suspension will be used more and more as time goes on, because of the lower cost of repairs on body parts and springs, and the smoother riding qualities. Squad members should become thoroughly familiar with the operation of air-suspension systems in all the types of vehicles based in their area, as well as those which may pass through their area.

FARM ACCIDENTS

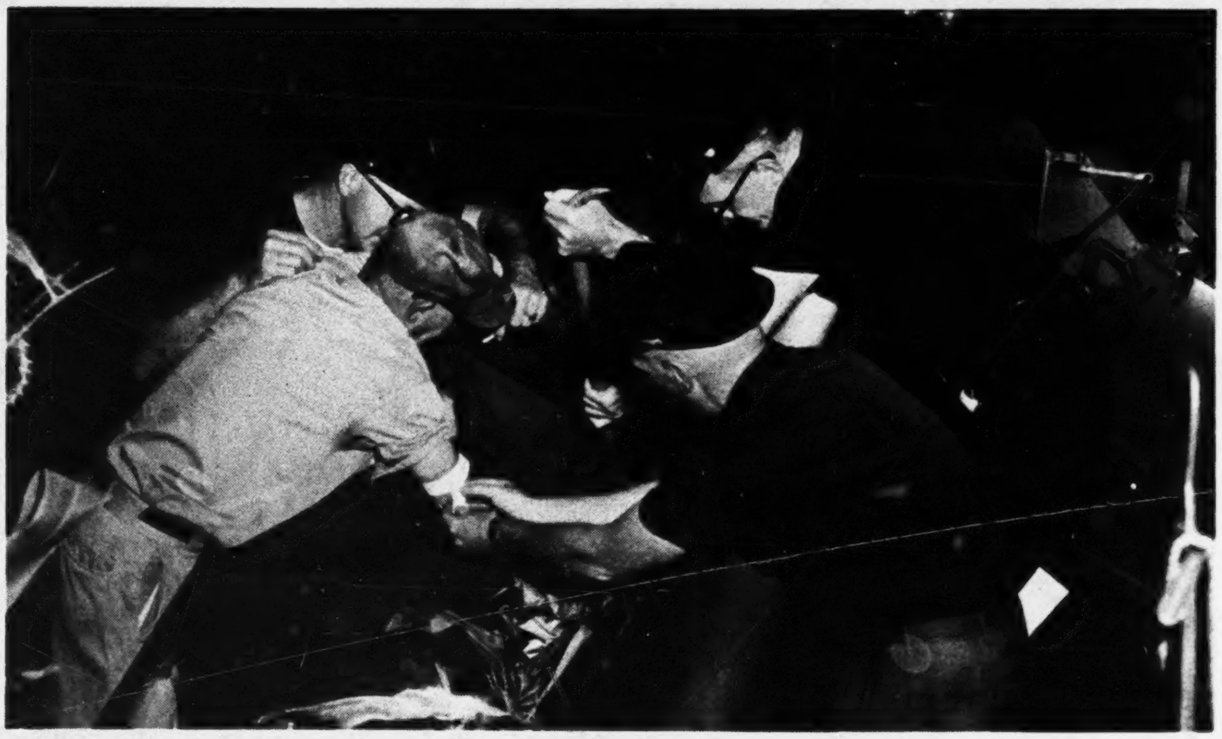
Squads that operate in rural areas are often involved in farm accident rescues. Figures 7 through 12 show the steps taken to rescue a man whose hand was caught in a corn picker when he attempted to unclog it.



Courtesy Loudonville Vol. F.D.

Figure 19

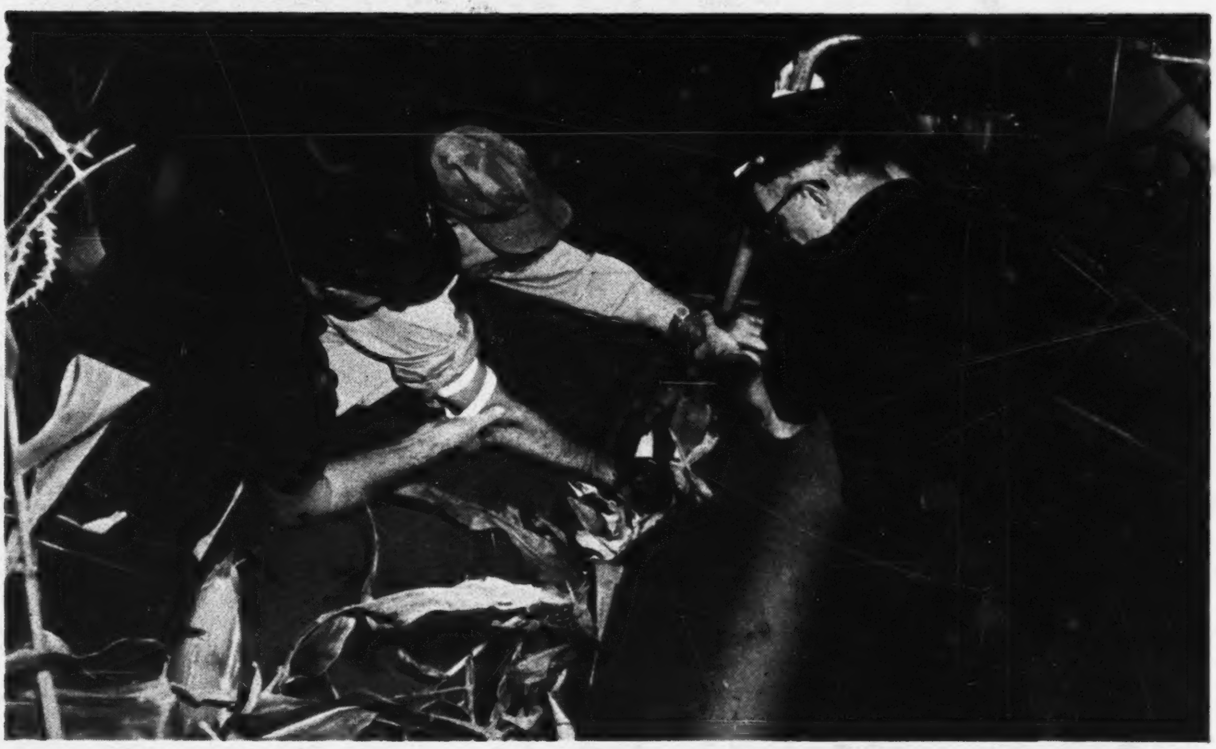
Squadman No. 1 is using an adjustable end wrench to remove a belt, so rollers can be spread. Squadman No. 2 sizes up the problem. Note gloved hand between rollers.



Courtesy Loudonville Vol. F.D.

Figure 20

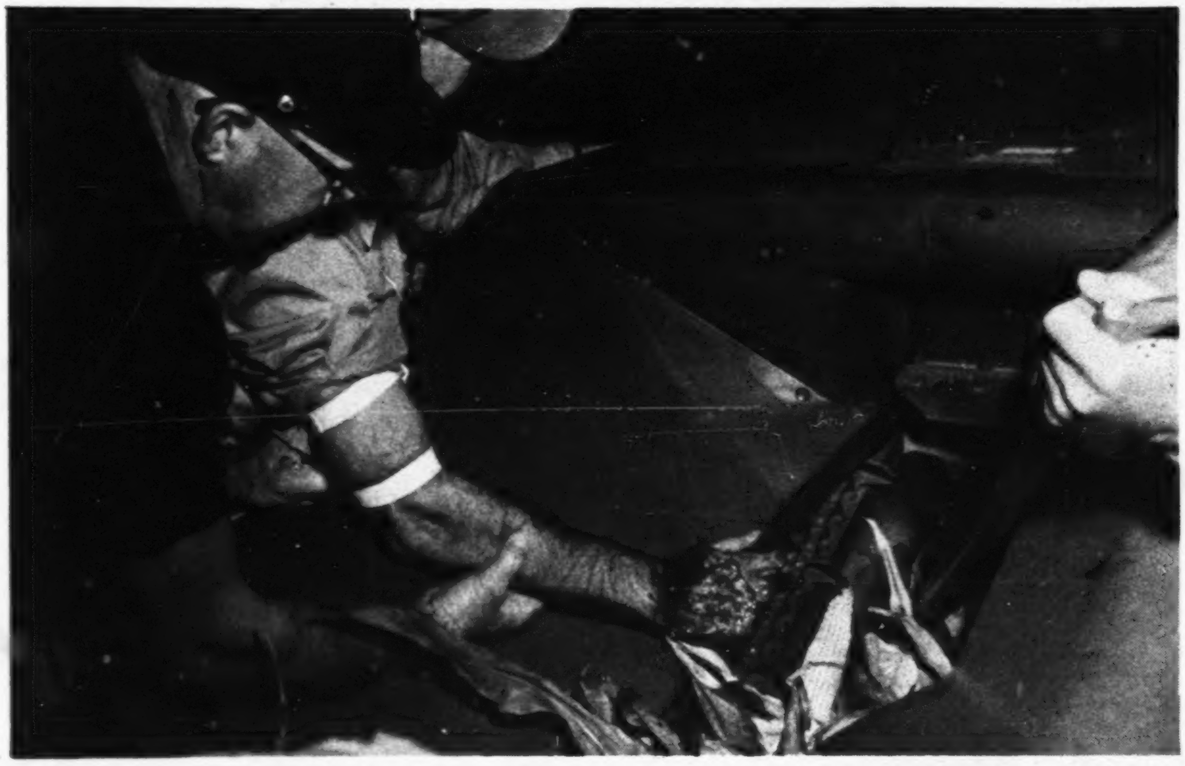
Squadman No. 1 helps the victim inhale from an ammonia capsule. Squadman No. 2 applies a tourniquet. Squadman No. 3 pries with hux bar.



Courtesy Loudonville Vol. F.D.

Figure 21

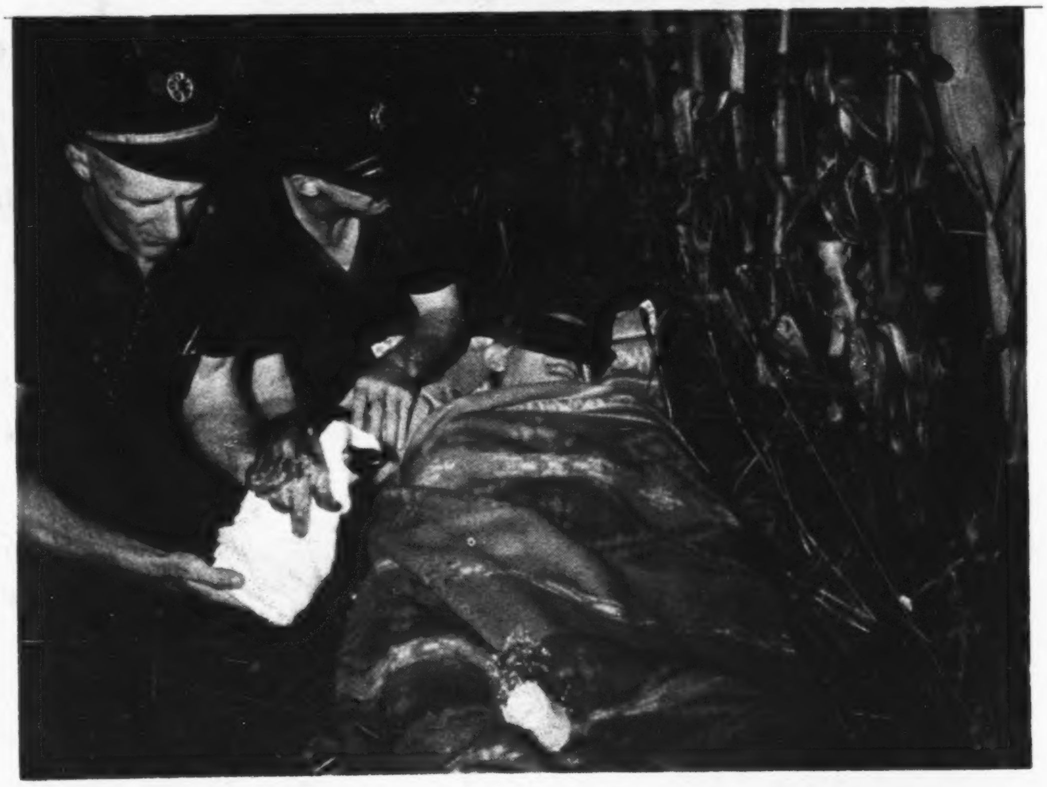
Squadman No. 1 assists in removing victim's hand. Squadman No. 2, not shown, has gone to make up a cot. Squadman No. 3 continues to pry with hux bar.



Courtesy Loudonville Vol. F.D.

Figure 22

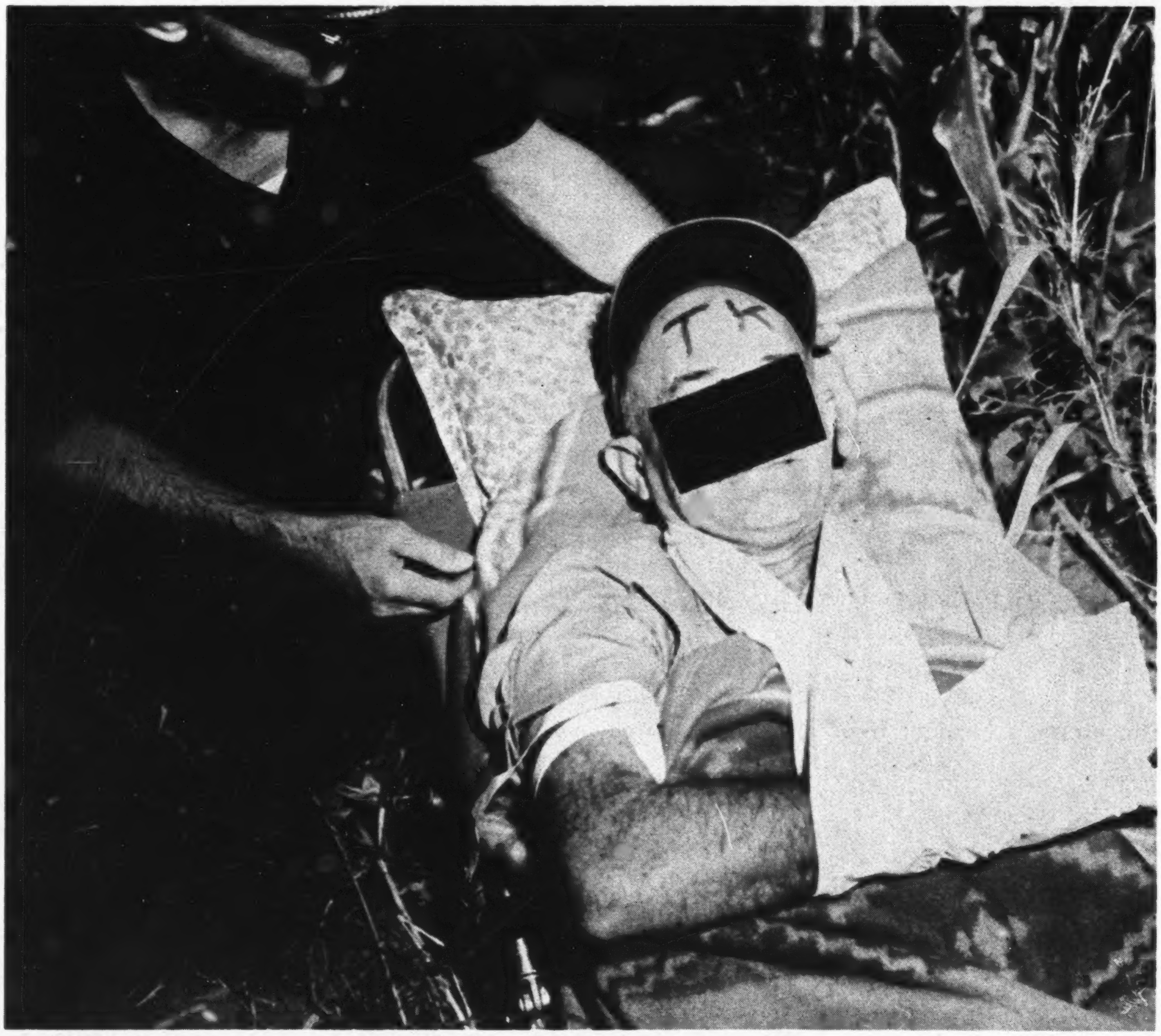
The victim's hand is freed. He is supported and reassured by squadmen.



Courtesy Loudonville Vol. F.D.

Figure 23

Squadmen give first aid. They wrap the victim's hand and treat him for shock.



[redacted]

Courtesy Loudonville Vol. F.D.

Figure 24

This victim will be covered with one more blanket, and transported to the hospital. Since the tourniquet and injury will be concealed under the blanket, the letters TK are written on the victim's forehead with an iodine swab.

OPERATIONS AT A CRIME SCENE

The following information should be of help to all squads. The outlined procedure should be followed at all suspected crime scenes.

Emergency care should not be jeopardized or sacrificed at any time. If there is any thought whatsoever that life may still be present, the care of the patient must take precedence over all other things.

Protecting The Scene

The scene of any unusual death such as at a fire, accident, explosion, unnatural death, etc., should be treated as a crime scene until proven otherwise. If squadmen arrive ahead of any law officers, they should assume the responsibility of protecting the scene.

1. The primary object to be guarded may be a body, an automobile, a room, or an entire building.
2. An area around the primary object may also require protection, depending on the type of crime.

Authority should be turned over to the police agency as soon as a representative arrives. If a patient must be transported to a hospital, one squadman could be left at the scene to await the arrival of the police agency.

Typical Procedure

All crime scene investigations more or less follow the same general pattern. The example treated here is a possible homicide. Parts of this procedure, of course, are not applicable in other types of crime.

The following information should be obtained promptly and transmitted to a police agency.

1. Name of deceased, if possible.
2. Exact address and location of the body.
3. Telephone number where squadman can be reached or is calling from.
4. Apparent cause and time of death, if known.
5. What assistance, if any, is needed.

Duties of the first squadmen at the scene are as follows:

1. If the victim must be moved for emergency care, mark in some manner an outline of the body.
2. KEEP THE SCENE INTACT--AS IS. Never touch, change, or alter anything until investigators arrive.
3. Get the names and addresses of witnesses and persons at the scene.
4. Get the name and address of the person who summoned the squad.
5. Note the weather condition at the time of your arrival.
6. Note the exact position of the body and the condition of the victim's clothing.
7. Note the condition of the victim's hands and any objects in his hands.
8. Note the size and condition of blood stains, if any.
9. If a weapon is found, do not touch it - push it aside or pick it up with a cloth. The weapon should be touched only in the most extreme emergency.

10. All persons found on the scene should be detained for examination, and no unauthorized persons should be admitted to the scene.

11. Do not remove a dead body unless so authorized by the coroner or officer in charge of squad.

12. At least one squadman should reamin with the body at all times, until he is relieved by a police agency.

13. Squadmen should not theorize or gossip with citizens about facts of the case. All such information should be given to investigating officers.
14. Note the time of arrival at scene and the names of squad officers present.

Records

All pertinent information should be kept on the squad report at squad headquarters. It may be subpoenaed later, as evidence.

CHAPTER XXIV

RECORDS AND REPORTS

INTRODUCTION

Proper reporting and record keeping are extremely important in the operation of an emergency or rescue squad. This chapter discusses important items of information that should be included on reports for successful operation and future reference. Sections of a squad report sheet are shown one at a time, and important items are discussed. Each section extends across both columns with the explanatory text running consecutively from column to column. The complete report form is shown on page 313, together with several other sample run reports and a typical monthly summary report. (Figures 1 through 6 .)

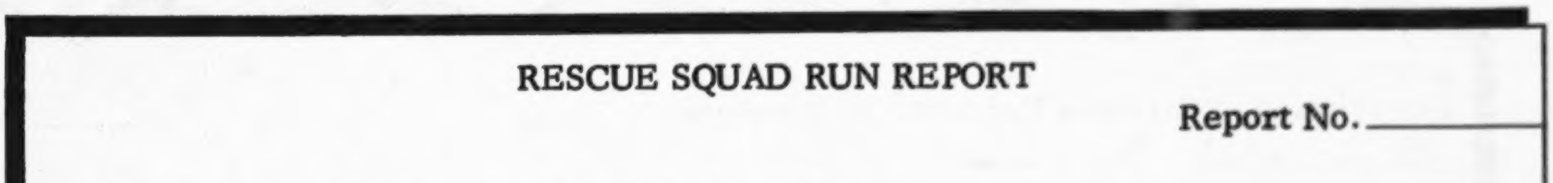
RESPONSIBILITY FOR REPORTS

The responsibility for reports is determined by local authority, such as the squad chief or fire chief. It is his duty to designate who is to be responsible. In many rescue squad organizations the chief responds to most calls. If this is the practice, the chief will usually complete the necessary reports. In any case it should be established who is responsible for filling out a complete squad report.

IMPORTANT ITEMS ON SQUAD REPORTS

RECEIVING AND RESPONDING TO ALARM

The date, time of receiving alarm, and location should be placed at or near the top of the report. Many squad reports provide a place to record "How the Alarm Was Received", that is, by telephone, messenger, police, radio, alarm system, etc. Some rescue squad run reports include "Time of Arrival at Emergency Location" and "Mileage".



RESCUE SQUAD RUN REPORT

Report No. ____________

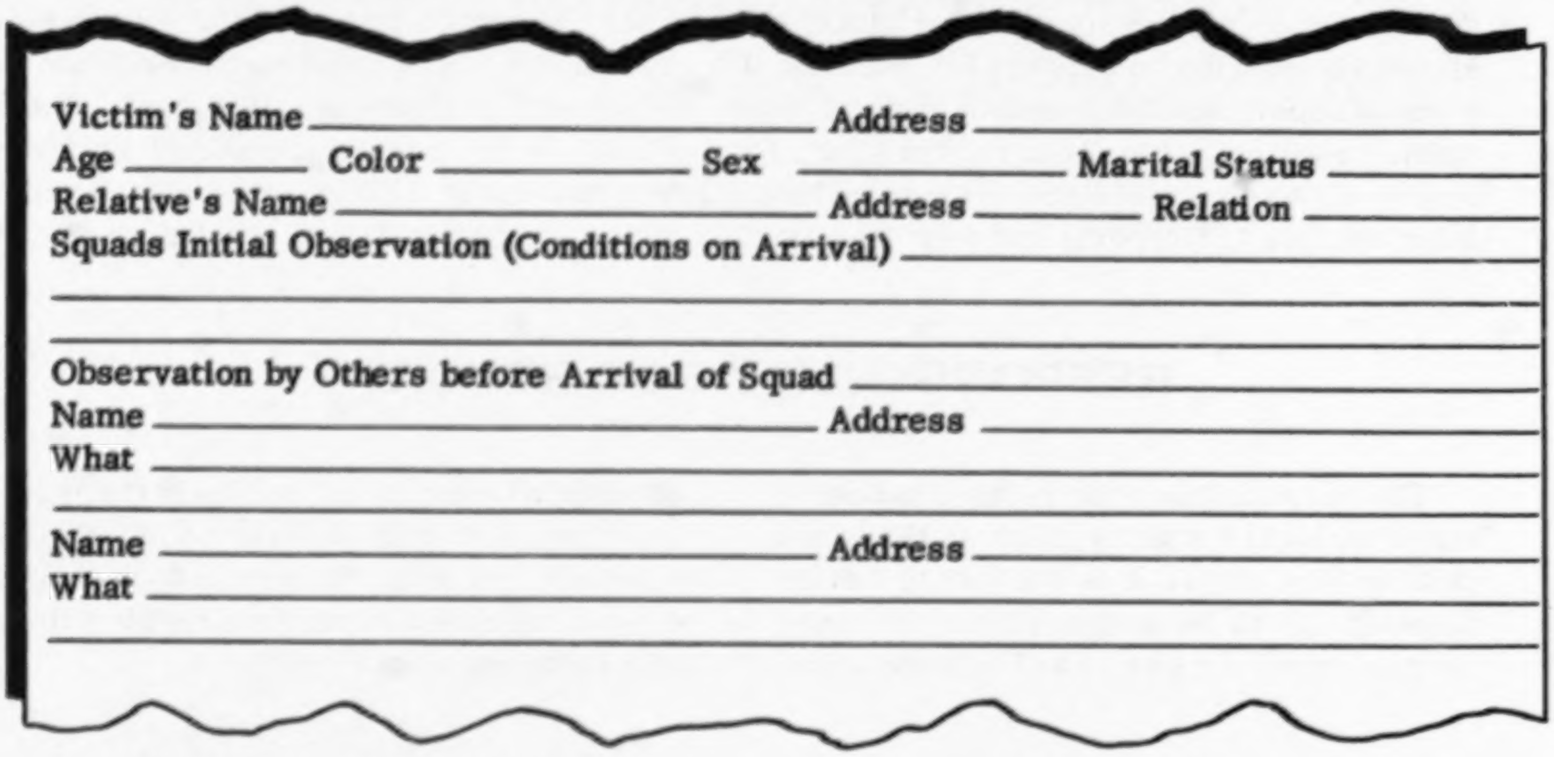
Date __________ Time _____ AM PM Location ______________________________
Condition of Weather ______________ Streets ____________ Traffic ____________
Alarm Received via - Telephone __________ Radio __________ Other ____________
Time of Arrival at Emergency Location ____ AM_PM __ Mileage ____________

OBSERVING THE CONDITION OF A VICTIM WHEN FOUND

Space should be provided for the name and address of the victim, plus a brief but complete explanation of the squadman's initial observation of the situation.

Space should also be provided to record the names and addresses and important information received from persons who were at the scene before the squad's arrival.

On many report forms the back of the sheet is blank, allowing ample room to include additional information. If data are recorded on a separate sheet of paper, it should be securely attached to the report form for reference.



Victim's Name __________ Address __________

Age _____ Color _____ Sex _____ Marital Status _____

Relative's Name __________ Address _____ Relation _____

Squads Initial Observation (Conditions on Arrival) __________

Observation by Others before Arrival of Squad __________

Name __________ Address __________

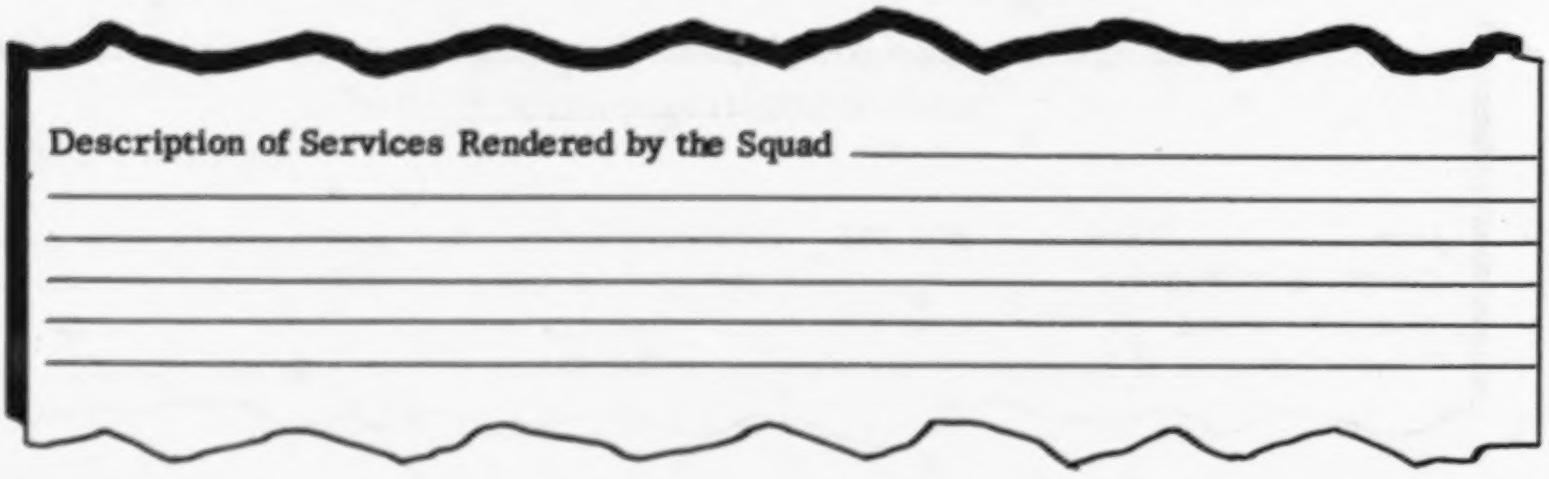
What __________

Name __________ Address __________

What __________

FIRST AID GIVEN BY THE SQUAD

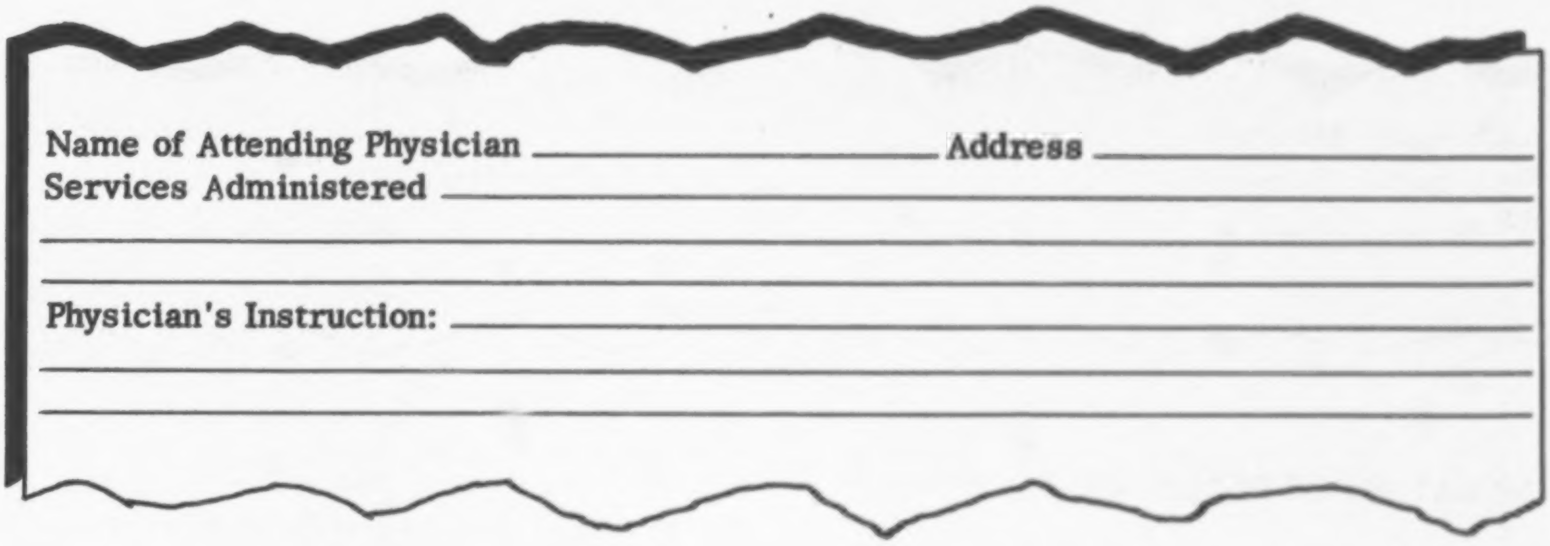
A description of the first aid and other important services given by the squad should be included on the report. Here too, the reverse side of the report or a separate sheet of paper may be used.



Description of Services Rendered by the Squad __________

MEDICAL SERVICES PROVIDED BY A PHYSICIAN AT THE SCENE

This information should be requested from the attending physician and be entered on the report. Space should be provided for the attending physician's name and address, the services he provided, and his instructions or suggestions either to the squad or to hospital personnel. Presenting a scratch pad with pencil to the physician at an appropriate time may assist a squadman to obtain this information.



Name of Attending Physician ____________ Address ____________

Services Administered ____________

____

____

Physician's Instruction: ____________

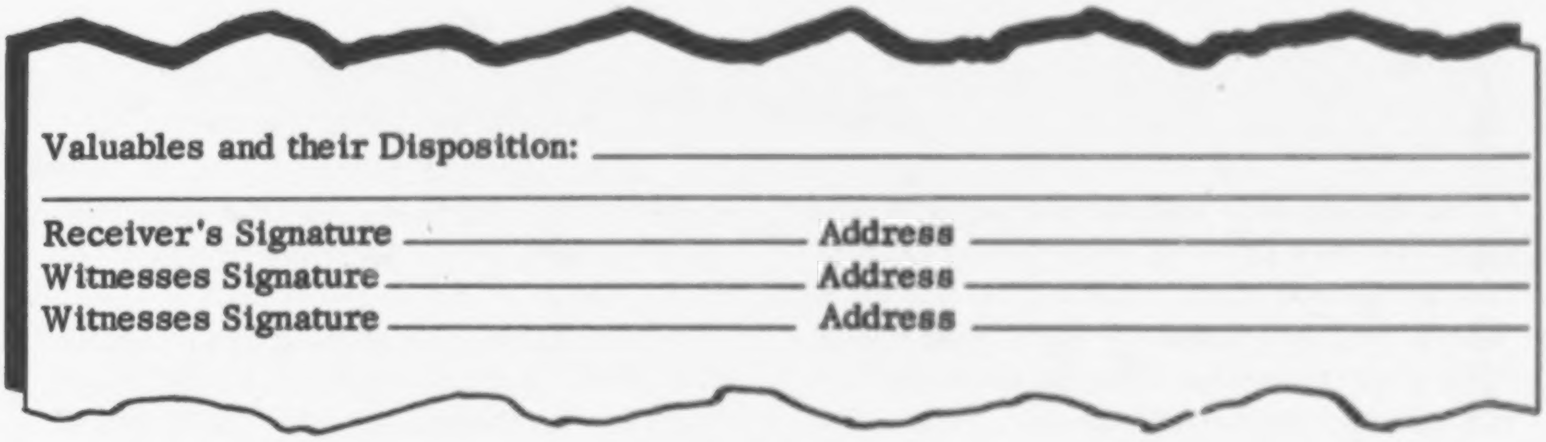
____

____

HANDLING OF VALUABLES

Proper handling of valuables at an emergency is extremely important, and all personal items should be treated as valuable. An item which has little monetary value may be regarded by someone as extremely valuable because it is a gift or keepsake.

It is very important to make out an itemized list, properly signed and witnessed, when valuables are put in the trust of a squadman or others. Usually valuables are not taken from victims who are conscious. (Usually this is left up to the police or hospital.)



Valuables and their Disposition: ____________

____

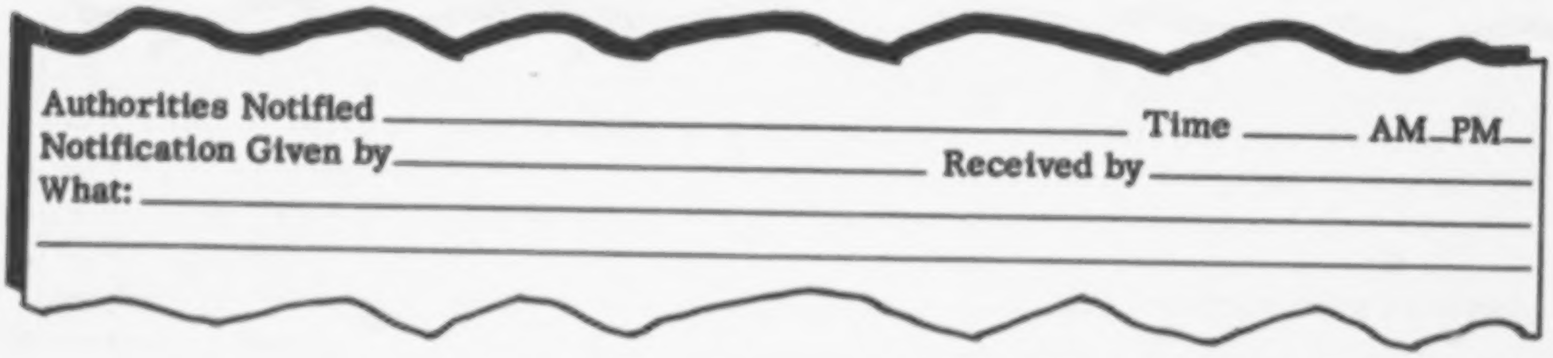
Receiver's Signature ____________ Address ____________

Witnesses Signature ____________ Address ____________

Witnesses Signature ____________ Address ____________

NOTIFYING PROPER AUTHORITIES

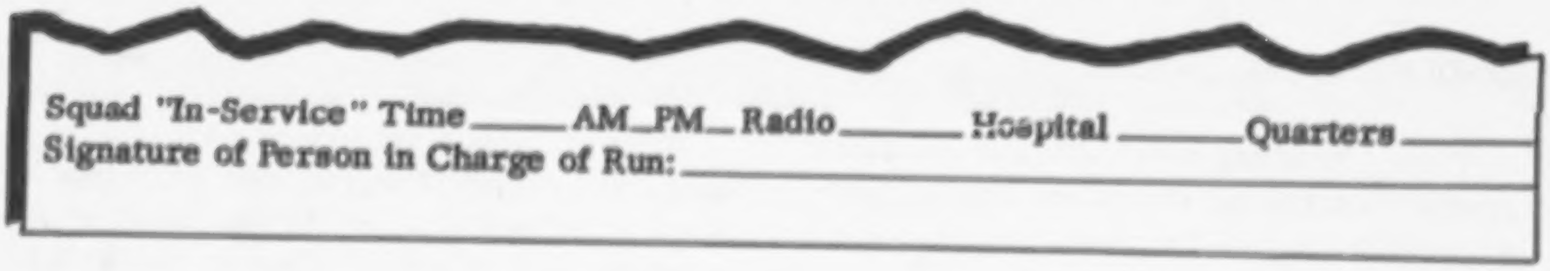
In some situations squadmen may be required to notify the coroner, a police agency, or the state fire marshal's office. In this case the name and title of the person receiving the information should be requested and made a part of the report, along with the hour of the day when he was notified. Sometimes the dispatcher obtains this information, rather than the squadman at the scene. Whatever action is taken, it must conform with the local, state, and federal laws.



Authorities Notified ____________________ Time ______ AM__PM__
Notification Given by ____________________ Received by ______________
What: ____
____
____

SIGNATURE OF PERSON MAKING REPORT

No report is complete without the signature of the person who made it. Local department rules may require more than one signature.



Squad "In-Service" Time ______ AM__PM__ Radio ______ Hospital ______ Quarters ______
Signature of Person in Charge of Run: ________________________________

SAMPLE REPORTS

Several sample reports are shown here to assist rescue squad officers in selecting or developing a report best suited to their needs. Some of these samples ask for additional kinds of information, which various squads have found to be helpful.

SUMMARY

Gathering data and completing a report must not take priority over victim care or transportation of victims to a hospital. There may be occasions when information for a report must be obtained after the victim has been removed from the scene. The need for accurate and complete reports should never be minimized; however, reports must never take precedence over victim care.

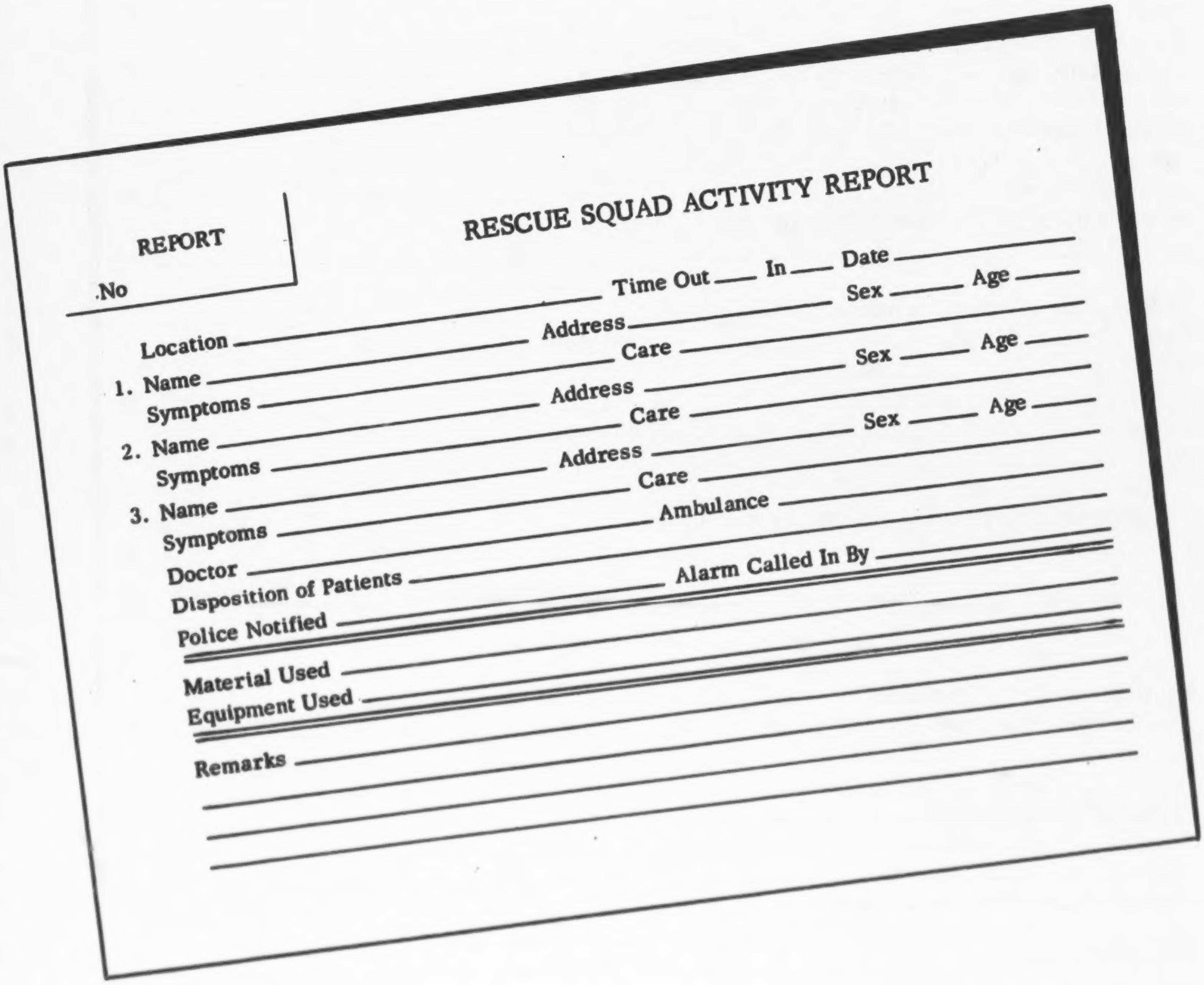
Rescue squad records can be subpoenaed into court. A complete and accurate report reflects the efficiency and professional competence of the squad.

RESCUE SQUAD RUN REPORT

Report No. ________

Date ________ Time ____ AM PM Location ______________________________
Condition of Weather ______________ Streets ____________ Traffic ______________
Alarm Received via - Telephone ____________ Radio ____________ Other ______________
Time of Arrival at Emergency Location ____ AM PM Mileage ________ ____
Victim's Name ______________________________ Address ______________________________
Age ________ Color ______________ Sex ________ Marital Status ____________
Relative's Name ____________________________ Address __________ Relation ____________
Squads Initial Observation (Conditions on Arrival) ______________________________
____
____
Observation by others before arrival of squad ______________________________
Name ______________________________ Address ______________________________
What ______________________________ ______________________________
____
Name ______________________________ Address ______________________________
What ____
____
Description of Services Rendered by the Squad ______________________________
____
____
____
____
____
Name of Attending Physician ____________________ Address ____________________
Services Administered ____
____
____
Physician's Instruction: ____
____
____
Valuables and their Disposition: ______________________________________
____
Receiver's Signature ____________________ Address ______________________________
Witnesses Signature ____________________ Address ______________________________
Witnesses Signature ____________________ Address ______________________________
Authorities Notified ______________________________ Time ______ AM PM
Notification Given by ____________________________ Received by ______________
What: ____
____
Squad "In-Service" Time ______ AM PM Radio ________ Hospital ______ Quarters ________
Signature of Person in Charge of Run: ______________________________________

Figure 1

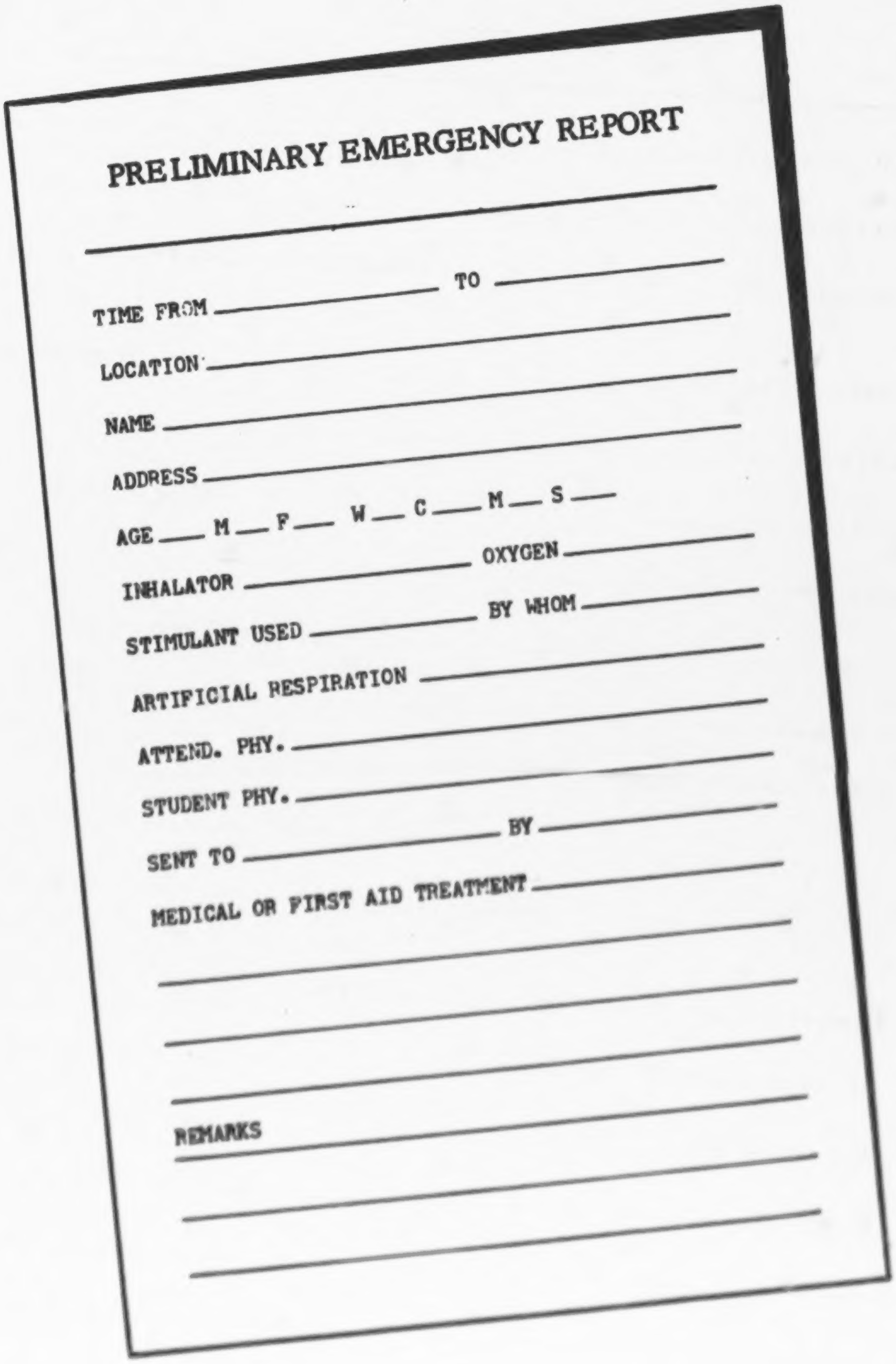


REPORT
No ____

RESCUE SQUAD ACTIVITY REPORT

Location ____ Time Out ____ In ____ Date ____
1. Name ____ Address ____ Sex ____ Age ____
Symptoms ____ Care ____
2. Name ____ Address ____ Sex ____ Age ____
Symptoms ____ Care ____
3. Name ____ Address ____ Sex ____ Age ____
Symptoms ____ Care ____
Doctor ____ Ambulance ____
Disposition of Patients ____ Alarm Called In By ____
Police Notified ____
Material Used ____
Equipment Used ____
Remarks ____

Figure 2



PRELIMINARY EMERGENCY REPORT

TIME FROM ______ TO ______

LOCATION ______

NAME ______

ADDRESS ______

AGE ___ M ___ F ___ W ___ C ___ M ___ S ___

INHALATOR ______ OXYGEN ______

STIMULANT USED ______ BY WHOM ______

ARTIFICIAL RESPIRATION ______

ATTEND. PHY. ______

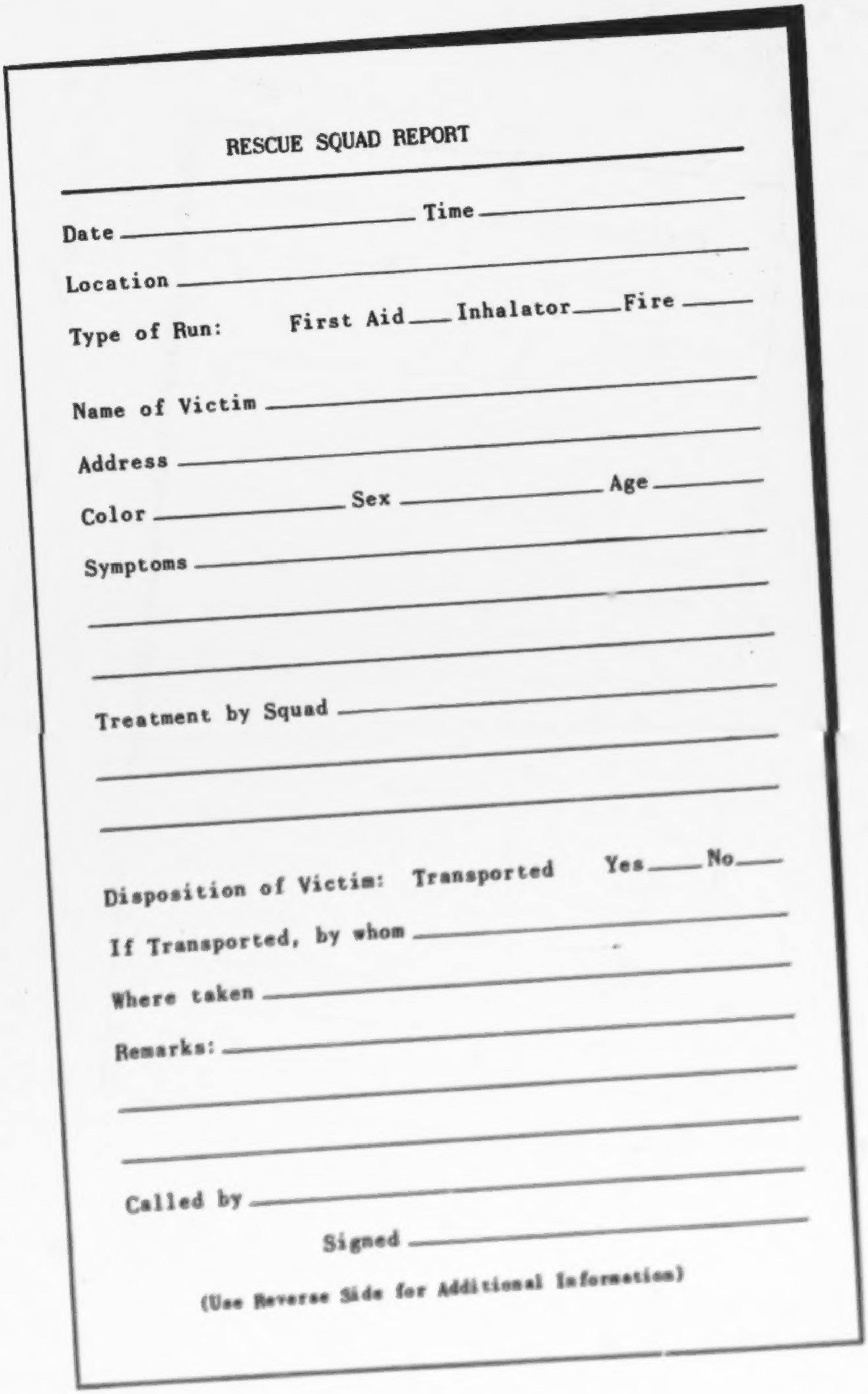
STUDENT PHY. ______

SENT TO ______ BY ______

MEDICAL OR FIRST AID TREATMENT ______

REMARKS ______

Figure 3



RESCUE SQUAD REPORT

Date ____________ Time ____________

Location ____________

Type of Run: First Aid ____ Inhalator ____ Fire ____

Name of Victim ____________

Address ____________

Color ____________ Sex ____________ Age ____________

Symptoms ____________

____

____

Treatment by Squad ____________

____

____

Disposition of Victim: Transported Yes ____ No ____

If Transported, by whom ____________

Where taken ____________

Remarks: ____________

____

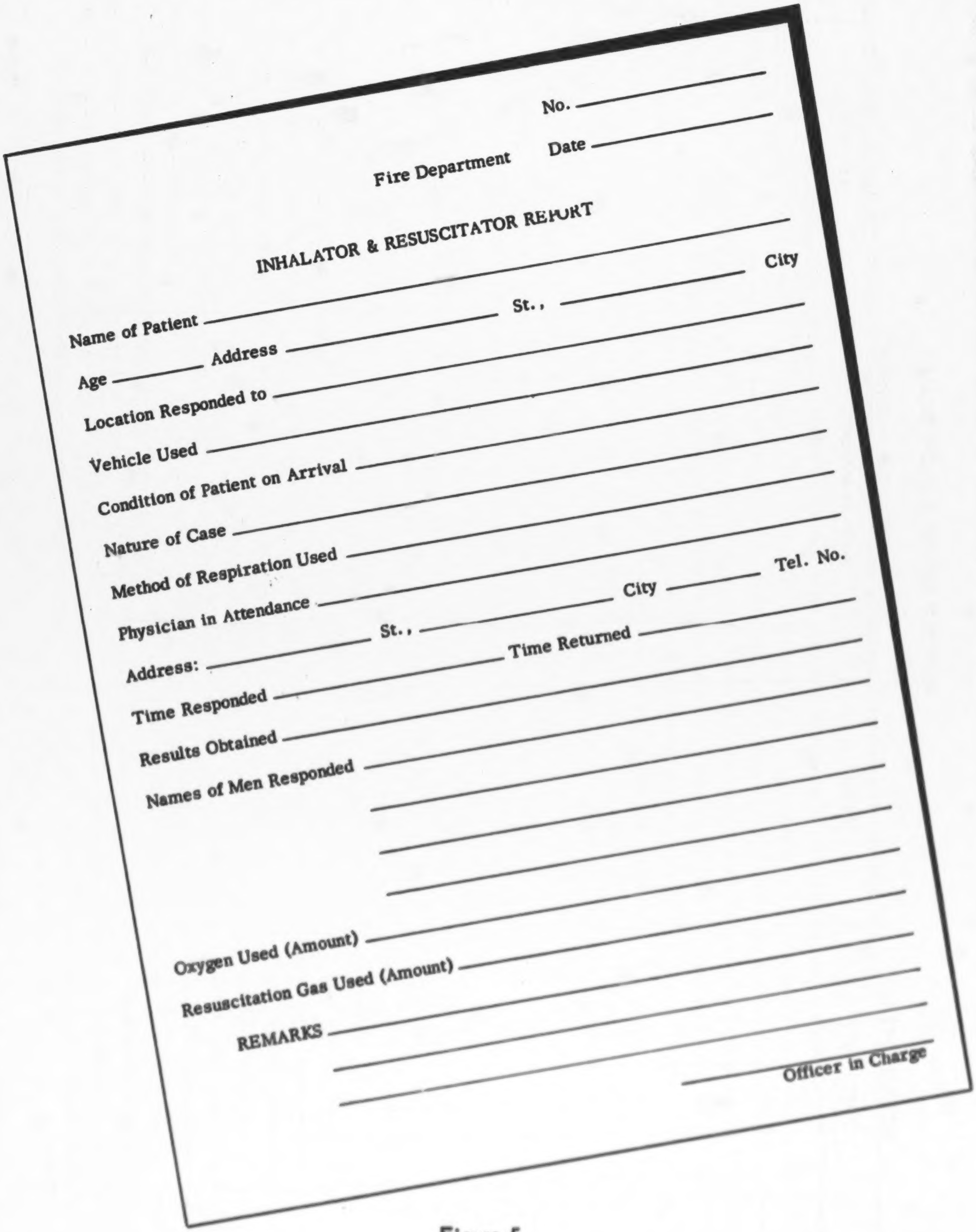
____

Called by ____________

Signed ____________

(Use Reverse Side for Additional Information)

Figure 4



No. ______

Date ______

Fire Department

INHALATOR & RESUSCITATOR REPORT

Name of Patient ______

Age ______ Address ______ St., ______ City

Location Responded to ______

Vehicle Used ______

Condition of Patient on Arrival ______

Nature of Case ______

Method of Respiration Used ______

Physician in Attendance ______ Tel. No.

Address: ______ St., ______ City ______

Time Responded ______ Time Returned ______

Results Obtained ______

Names of Men Responded ______

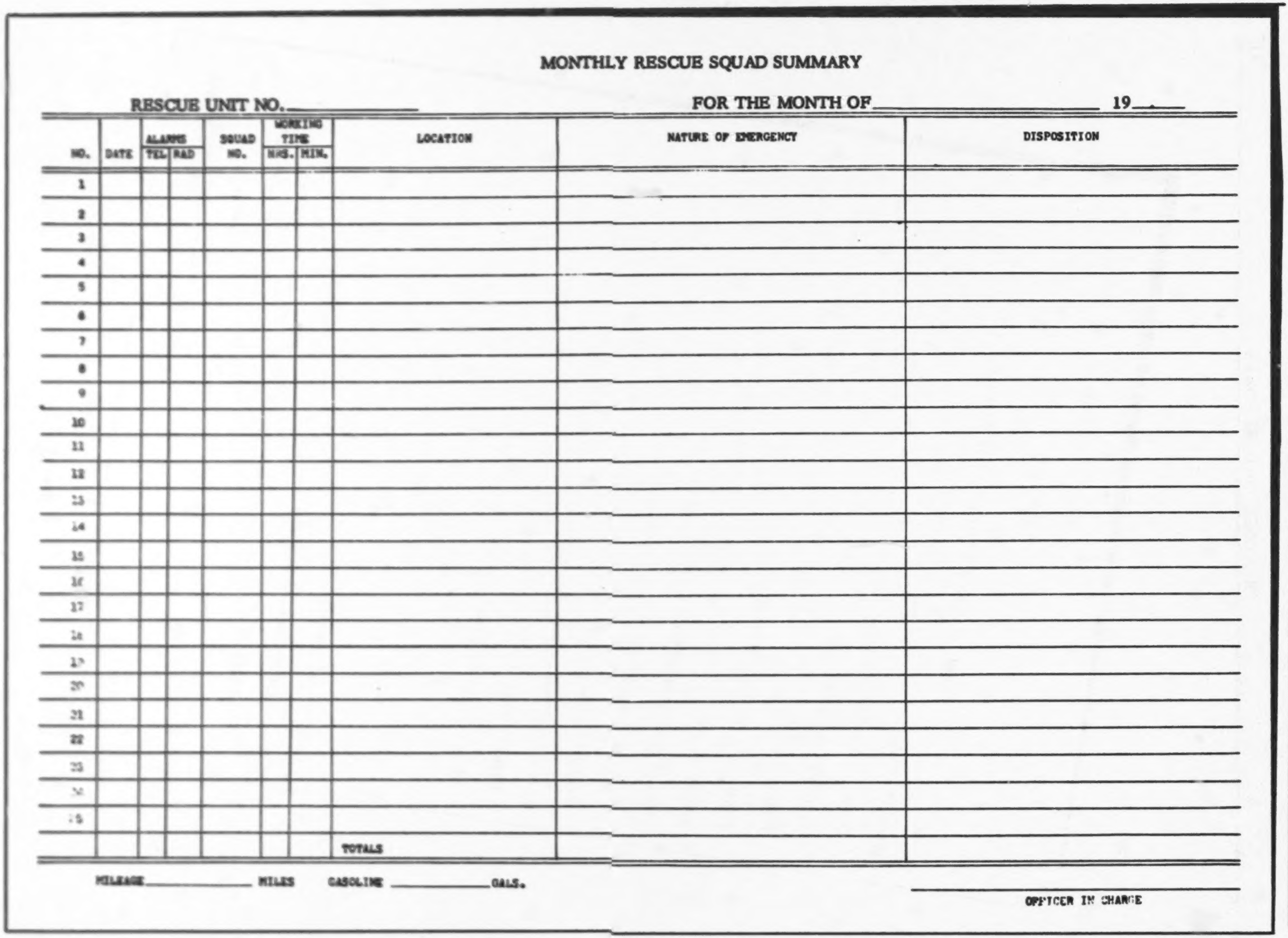
Oxygen Used (Amount) ______

Resuscitation Gas Used (Amount) ______

REMARKS ______

______ Officer in Charge

Figure 5



MONTHLY RESCUE SQUAD SUMMARY

RESCUE UNIT NO.__________ FOR THE MONTH OF________________ 19___

NO.	DATE	ALARMS		SQUAD NO.	WORKING TIME		LOCATION	NATURE OF EMERGENCY	DISPOSITION
		TEL	RAD		HRS.	MIN.			
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
							TOTALS		

MILEAGE__________ MILES GASOLINE __________ GALS.

____

OFFICER IN CHARGE

Figure 6

CHAPTER XXV

POST MORTEM CONFERENCE

INTRODUCTION

A post mortem conference is an evaluation of what has taken place during the course of an emergency.* It will point out what can be done in the future to expedite procedures and achieve a more efficient operation.

A definite pattern for scheduling post mortems cannot be established for all emergency and rescue units, as methods of operation within each department may differ.

WHY CONDUCT A POST MORTEM CONFERENCE?

In emergency squad work a second chance to save a life is never guaranteed. However, an evaluation of past performance often yields information that will make the handling of future problems more efficient. Emergencies are not always routine, and squad procedures cannot always be spelled out in detail, in advance. If during an emergency something happens for which the squadman's training and instructions have not prepared him, he should not "pass the buck" afterward. Rather, he should welcome constructive criticism, opinions, advice, and ideas. He should treat this phase of squad work as one involving "fact finding", not "fault finding".

Pre-planning has been emphasized and referred to many times in this text. A combination of pre-planning and post mortems is essential to efficient operation. If a squad carries out post mortems conscientiously mistakes made in the past will be the stepping stones to success in the future.

HOW TO CONDUCT THE CONFERENCE

Post mortems must be based on facts, not hearsay. The report on the case in question should always be used. Such a report should indicate action taken from the time the squad left the station until it returned to service. A review of this action should form the basis for the post mortem discussion. As materials are reviewed, new ideas which may be of value on future calls may be introduced for consideration and evaluation.

These discussions must not reflect on the judgment of the squadmen involved. The officer in charge must stress the importance of honest, constructive criticism if he wishes to obtain the full cooperation of his men. The post mortem must be treated open-mindedly by all concerned.

---

* The term post mortem as used in emergency squad work refers to a conference held to discuss any completed squad operation. It does not imply a death, as in the more restrictive medical use of the term.

SCHEDULING A CONFERENCE

The time for conducting a post mortem must be arranged in compliance with the rules, regulations and methods of operation of the squad. In general, however, post mortems should be held as soon after the run as practical so that the facts will still be fresh in the minds of those who were involved in the emergency. In a paid department, it is usually possible to hold discussions immediately after the run is completed. The informal discussion which often takes place in both paid and volunteer squads, while equipment is being checked and cleaned, can be of much value. In paid departments post mortems may be held at the time of the change of shifts. Often run reports are reviewed by officer personnel going on and off duty.

Some volunteer squads have regular meetings where matters of interest and importance are thoroughly discussed. This is an excellent time to conduct the post mortem. Thus, personnel not on duty when the emergency took place can be filled in and briefed on the situation; their opinions and ideas can be evaluated.

In setting up a plan for carrying out post mortems, the results will justify the efforts expended.

Post mortems held in conjunction with training sessions are excellent proving grounds for technique and methods which can be tried and practiced.

RESPONSIBILITY AND PARTICIPATION

The responsibility for post mortems rests with the person who is in charge of the squad or its operation.

The underlying purpose of a post mortem is to gain the most benefits for all personnel. At one time the usual procedure was to include only the officer personnel in a squad. However, no officer is any more efficient - in a general sense - than the degree of efficiency of his men. Enlisting the cooperation of all personnel creates a feeling of trust and confidence resulting in a mutual net gain to all concerned. The surest way to gain a person's cooperation is to ask for his help. If a satisfactory conclusion or evaluation is to be expected, all personnel involved should have a part. They will be affected by most decisions regarding policy change or the need for training.

ITEMS TO BE EVALUATED

A pattern should be established and followed in conducting such a session. The following items should be covered:

1. Receiving the call
    a. Was there anything unusual about it?

2. Answering the call
    a. Was a different route taken?
    b. Was there an unusual traffic problem?
    c. Is there a better route?

3. On arrival
    a. Were there any unusual circumstances?

4. Care given victim
    a. What?
    b. When?
    c. How?
    d. Reaction of victim?
    e. Results of care?

5. Equipment
    a. What equipment was used?
    b. Was equipment in place?
    c. Was it in good working order?

6. Control of family and/or public
    a. Outstanding difficulties
    b. Action taken to handle difficulties in control

7. Medical assistance
    a. Was physician called?
    b. Family or other physician?
    c. Success or failure in obtaining a physician

8. Transportation
    a. Problems encountered

9. Hospital
    a. Condition of victim
    b. Problems encountered at hospital

10. Law-Enforcement agencies
    a. Were they notified?
    b. Were there any problems with officers?

11. Actions that merit special praise
    a. Were there any regular personnel (medical, hospital, police) who made any extra or special effort to help the squad in meeting the emergency?

    b. Did the squad receive special help from a utility company, heavy equipment operator, etc.?

    c. Have any such personnel been thanked for their special cooperation?

CHAPTER XXVI

LEGAL ASPECTS

INTRODUCTION

This chapter contains statutes taken from the Revised Code of Ohio having reference to emergency squads. It is by no means complete; many more can be found in the index to the Revised Code of Ohio.

Whenever there is a question of legal interpretation involved in a particular case, such legal interpretation should be left to the county prosecutor or city solicitor.

NOTE: References are keyed as follows:

R. C. - Refers to the Revised Code of Ohio

G. C. - Refers to the Ohio General Code which antedated the Revised Code. References to the General Code are for historical purposes only.

STATUTES

DEFINITIONS OF EMERGENCY VEHICLES

R. C. Section 4511.01 (D)
(G. C. Section 6307-2)

"Emergency Vehicle" means fire department, police, and state highway patrol vehicles, vehicles of salvage corporations organized under Sections 1709.01 to 1709.07, inclusive, of the Revised Code, emergency vehicles of municipal or county departments or public utility corporations when identified as such as required by law, the director of highways, or local authorities, motor vehicles when commandeered by a police officer, ambulances, and motor vehicles when used by volunteer firemen responding to emergency calls in the fire department service when identified as required by the director.

To make the identification of a vehicle complete, a windshield decal is necessary. A list of all men who are entitled to receive decals, to get the protection given to an "emergency vehicle", should be prepared and certified by the association secretary or fire chief and mailed to the State Fire Marshal's Office in Columbus, Ohio. The decal is to be placed in the lower right-hand corner of the windshield. If the auto is exchanged, a new registration is required and the decal must be removed from the old car. Only men who are members of fire departments may obtain decals.

EMERGENCY VEHICLES HAVE RIGHT OF WAY

R. C. Section 4511.45

(G. C. Section 6307-44)

Upon the approach of an emergency vehicle, equipped with at least one flashing red light visible under normal atmospheric conditions from a distance of five hundred feet to the front of such vehicle and the driver is giving audible signal by siren, exhaust whistle, or bell, the driver of every other vehicle shall yield the right-of-way, immediately drive to a position parallel to, and as close as possible to, the edge or curb of the highway clear of any intersection, and stop and remain in such position until the emergency vehicle has passed, except when otherwise directed by a police officer.

Upon the approach of an emergency vehicle, as stated in the first paragraph of this section, the operator of every street car or trackless trolley shall immediately stop such car clear of any intersection and keep it in

This section does not relieve the driver of an emergency vehicle from the duty to drive with due regard for the safety of all persons and property upon the highway.

EMERGENCY VEHICLE TO PROCEED CAUTIOUSLY PAST RED OR STOP SIGNAL

R. C. Section 4511.03

The driver of any emergency vehicle, when responding to an emergency call, upon approaching a red or stop signal or any stop sign shall slow down as necessary for safety to traffic, but may proceed cautiously past such red or stop sign or signal with due regard for the safety of all persons using the street or highway.

EMERGENCY VEHICLE EXCEPTED FROM SPEED LIMITATIONS

R. C. Section 4511.24

(G. C. Section 6307.24)

The prima-facie speed limitations set forth in section 4511.21 of the Revised Code do not apply to emergency vehicles when they are responding to emergency calls, and when the drivers thereof sound audible signals by bell, siren, or exhaust whistle. This section does not relieve the driver of an emergency vehicle from the duty to drive with due regard for the safety of all persons using the street or highway.

HORNS, SIRENS, AND WARNING DEVICES

R. C. Section 4513.21

(G. C. Section 6307-93)

Every motor vehicle or trackless trolley when operated upon a highway shall be equipped with a horn which is in good working order and capable of emitting should audible, under normal conditions, from a distance of not less than two hundred feet.

No motor vehicle or trackless trolley shall be equipped with, nor shall any person use upon a vehicle, any siren, whistle, or bell. Any vehicle may be equipped with a theft alarm signal device which shall be so arranged that it cannot be used as an ordinary warning signal. Every emergency vehicle shall be equipped with a siren, whistle, or bell, capable of emitting sound audible under normal conditions from a distance of not less than five hundred feet and of a type approved by the director of highways. Such equipment shall not be used except when such vehicle is operated in response to an emergency call or is in the immediate pursuit of an actual (or) suspected violator of the law, in which case the driver of the emergency vehicle shall sound such equipment when it is necessary to warn pedestrians and other drivers of the approach thereof.

LIABILITY OF MUNICIPAL CORPORATIONS FOR OPERATION OF VEHICLES

R. C. Section 701.02

(G. C. Section 3714-1)

Any municipal corporation shall be liable in damages for injury or loss to persons or property and for death by wrongful act caused by the negligence of its officers, agents, or servants while engaged in the operation of any vehicles upon the public highways of this state, under the same rules and subject to the same limitations as apply to private corporations for profit, but only when such officer, agent, or servant is engaged upon the business of the municipal corporation.

The defense that the officer, agent, or servant of the municipal corporation was engaged in performing a governmental function, shall be a full defense as to the negligence of:

(A) Members of the police department engaged in police duties;

(B) Members of the fire department while engaged in duty ay a fire, or while proceeding toward a place at where a fire is in progress or is believed to be in progress, or in answering any other emergency alarm.

Firemen shall not be personally liable for damages for injury or loss to persons or property and for death caused while engaged in the operation of a motor vehicle in the performance of a governmental function.

Policemen shall not be personally liable for damages for injury or loss to persons or property and for death caused while engaged in the operation of a motor vehicle while responding to an emergency call.

Opinions of the Attorney General

#1043 - Year, 1933

1. The proviso of section 3714-1, General Code enacted by the 90th General Assembly, operates to limit the general liability which is imposed upon municipalities by section 3714-1, General Code.

2. A municipal corporation is liable for the negligence of members of the fire department in operating fire apparatus when returning from a fire or other emergency alarm.

PURCHASE OF FIRE FIGHTING EQUIPMENT

R. C. Section 505.37

(G. C. Section 3298-54)

The board of township trustees may establish all necessary regulations to guard against the occurrence of fires, protect the property and lives of the citizens against damage and accidents and may, with the approval of the specifications by the prosecuting attorney, purchase or otherwise provide such fire apparatus, mechanical resuscitators or other equipment, appliances, materials, fire hydrants, and water supply for fire fighting purposes as seems advisable to the board....

Opinions of the Attorney General

#2416 - year 1953

Under the provisions of Section 3298-54, (R. C. Section 505.37) township trustees, in addition to being authorized to guard against the occurrence of fires, are further authorized to protect property and lives against damages and accidents; and under such authority may acquire and operate emergency vehicles or "rescue cars" for such purposes.

Township trustees may enter into an agreement with a volunteer fire company for the operation of any such equipment as the township itself is authorized to operate, designed to protect against fires, damages and accidents.

CONTRACTS FOR FIRE PROTECTION; STATUS OF MEMBERS OF FIRE DEPARTMENT

R. C. Section 505.44

(G. C. Section 3298-60) (G. C. Section 3298-60a)

In order to obtain fire protection, or to obtain additional fire protection in times of emergency, any township may enter into a contract, for a period not to exceed three years, with one or more townships, municipal corporations, or private fire companies, upon such terms as are agreed to by them, for services of fire departments, or the use of fire apparatus, or the interchange of the service of fire departments or use of fire apparatus, within the several territories of the contracting subdivisions and private fire companies, if such contract is first authorized by the respective boards of township trustees or other legislative bodies.

Section 701.02 of the Revised Code, as far as it is applicable to the operation of fire departments, applies to the contracting political subdivisions and fire department members when such members are rendering service outside their own subdivision pursuant to such contract.

Such contract may provide for a fixed annual charge to be paid at the times agreed upon and stipulated in the contract, or for compensation based upon a stipulated price for each run, call, or emergency, or the number of members or apparatus employed, or the elapsed time of service required in such run, call, or emergency. Such contract may provide for compensation for loss or damage to equipment or apparatus while engaged outside the limits of the subdivision or private fire company owning and furnishing it, and for the reimbursement of the subdivision or private fire company, in which the fire department members are employed, for any pension or indemnity award or premium contribution assessed against the employing subdivision or private fire company for workmen's compensation benefits or casualty insurance premiums for injuries or death of its fire department members occurring while engaged in rendering service pursuant to such contract.

As used in this section, "private fire company" means any group or organization not for profit owning and operating fire-fighting equipment not controlled by any township or municipal corporation.

Under R.C. Section 717.02, municipal corporations may similarly enter into contracts for services and for the use of apparatus.

NOTIFICATION IN CASE OF DEATH BY VIOLENCE OR SUICIDE

R. C. Section 313.11

(G. C. Section 2855-12)

Any person who discovers the body or acquires the first knowledge of the death of any person who died as a result of criminal or other violent means, or by casualty, or by suicide, or suddenly when in apparent health, or in any suspicious or unusual manner, shall immediately notify the office of the coroner of the known facts concerning the time, place, manner, and circumstances of such death, and of any other information which is required by Sections 313.01 to 313.22, inclusive, of the Revised Code.... No person shall willfully refuse to report such a death, or shall, without an order from the coroner, willfully touch, remove, disturb the body of any such person, or disturb the clothing or any article upon or near such body.

NOTIFICATION BY PHYSICIAN IN CASE OF DEATH BY VIOLENCE OR SUICIDE

R. C. Section 313.12

(G. C. Section 2855-5)

When any person dies as a result of criminal or other violent means, or by casualty, or by suicide, or suddenly when in apparent health, or in any suspicious or unusual manner, the physician called in attendance shall immediately notify the office of the conorer of the known facts concerning the time, place, manner, and circumstances of such death, and any other information which is required pursuant to Sections 313.01 to 313.22, inclusive, of the Revised Code.

The first responsibility of a squadman is to care for the living. If he finds, on arriving at an emergency, that death or injury is apparently due to unnatural causes, he should take precautions not to touch anything except to take charge of the emergency so far as the injured are concerned. In Chapter XXIII, the section "Operations at a Crime Scene" gives further suggestions for procedures in this kind of situation.

LIABILITY FOR EMERGENCY CARE

THE "GOOD SAMARITAN" LAW

R. C. Section 2305.23

No person shall be liable in civil damages for administering emergency care or treatment at the scene of an emergency outside of a hospital, doctor's office, or other place having proper medical equipment, for acts performed at the scene of such emergency, unless such acts constitute willful or wanton misconduct.

Nothing in this section applies to the administering of such care or treatment where the same is rendered for remuneration or with the expectation of remuneration.